Honeywell

Video Recorder VRX180

User Manual

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Honeywell

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This document was prepared using Information Mapping methodologies and formatting principles.

About This Document

Abstract

This manual describes the installation, configuration, operation, and maintenance of the Video Recorder.

Warranty

The device described herein has been manufactured and tested for correct operation and is warranted as follows: The Video Recorder carries an 18 month warranty. This warranty includes immediate technical assistance and replacement of the defective part or instrument, if necessary.

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Contact your local sales office of warranty information. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair of replace without charge those items it finds defective. ***The foregoing is Buyer's sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose.*** Specifications may change without notice. The information we supply is believed to be accurate and reliable as of printing. However, we assume no responsibility for its use. While we provide application assistance personally, through our literature and the Honeywell website, it is up to the customer to determine the suitability of the product in the application.

Contacts

If you encounter any problem with your video recorder, please contact your nearest Sales Office. (See the address list at the end of this manual).

An engineer will discuss your problem with you. **Please have your complete model number, serial number, and software version available.** Model number and serial number are located on the chassis nameplate. Software version can be viewed under Maintenance mode; see Section 8 of this manual.

If it is determined that a hardware problem exists, a replacement instrument or part will be shipped with instructions for returning the defective unit. Do not return your instrument without authorization from your Sales Office or until the replacement has been received.

Symbol Meanings

Symbol	What it means
	Protective ground terminal. Provided for connection of the protective earth green (green or green/yellow) supply system conductor.
	Functional ground terminal. Used for non-safety purposes such as noise immunity improvement.
	WARNING. Risk of electric shock. This symbol warns the user of a potential shock hazard where voltages greater than 30 Vrms, 42.4 Vpeak, or 60 Vdc may be accessible. **Failure to comply with these instructions could result in death or serious injury**
	CAUTION. When this symbol appears on the product, see the user manual for more information. This symbol appears next to the required information in the manual. **Failure to comply with these instructions may result in product damage.**

CE conformity

This product conforms with the protection requirements of the following European Council Directives: 89/336/EEC, the EMC directive, and 73/23/EEC, the low voltage directive. Do not assume this product conforms with any other “CE Mark” Directive(s).

Attention

The emission limits of EN 50081-2 are designed to provide reasonable protection against harmful interference when this equipment is operated in an industrial environment. Operation of this equipment in a residential area may cause harmful interference. This equipment generates, uses, and can radiate radio frequency energy and may cause interference to radio and television reception when the equipment is used closer than 30 meters to the antenna(e). In special cases, when highly susceptible apparatus is used in close proximity, the user may have to employ additional mitigating measures to further reduce the electromagnetic emissions of this equipment.

Contents

TABLES

Figures

1. Introduction

1.1 Video Recorder Overview

The Video Recorder (Figure 1-1) is part of the family of multi-point, multi-function video products. The instrument offers display versatility, flexible data storage, up to 8 control loops, each one can run its own profile, and advanced math functions. This integration of several functions eliminates the need for multiple devices and reduces installation costs.

The instrument features a high resolution LCD display which is capable of displaying up to 16 different colors simultaneously. The front door opens to allow access to a 100MB ZIP disk drive. A mini DIN connector can be used on the front door for connecting a PC keyboard or barcode reader for easy labeling of parameters. Barcode reader also stores Event Records to disk.

Sixteen panel keys control all functions of the instrument, including configuration.

The instrument will accept thermocouple, RTD, pyrometer, milliamp, millivolt and volt inputs. Up to eight analog outputs are available for retransmission or control. Data can be directed to various display formats, stored on floppy disk, or read from an optional serial communications link. Analog and discrete data can be displayed in trend or tabular format. Viewed data can be either “live” (real time inputs) or historical (retrieved from disk).

Flexible modular design and several options make this instrument adaptable to nearly any industrial application.

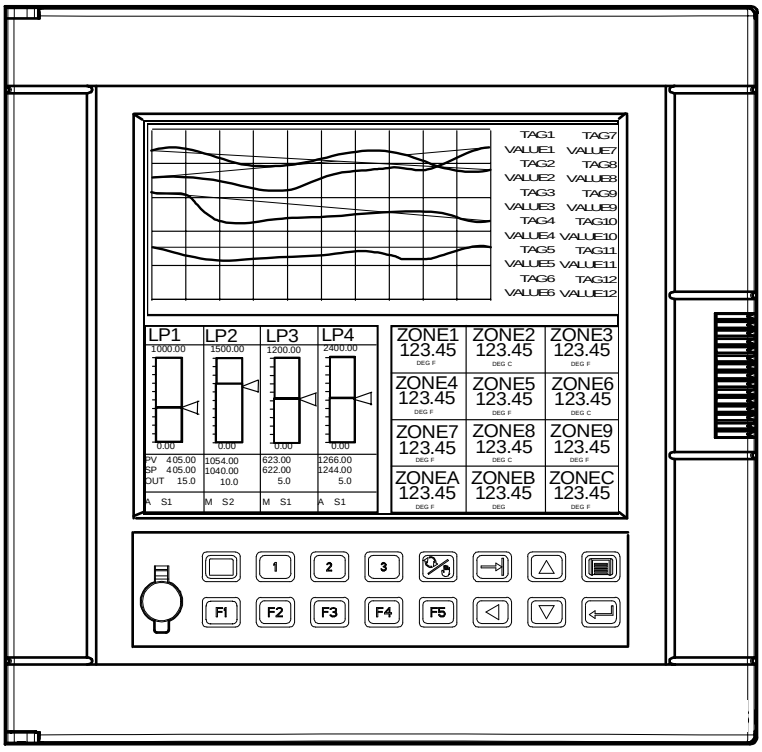


Figure 1-1 Video Recorder

1.2 Specifications

Table 1-1 Specifications

Physical	
Enclosure	Metal case and rugged die cast aluminium door and frame. High impact resistant polycarbonate keypad and glass or polycarbonate window. IP55 rating (NEMA 3) from front panel.
Mounting (Panel)	40 mm thickness (max.) (1,57")
Dimensions	Compact size: 320 mm (12.60") depth 310 mm front face height x 317 mm width (12.21" x 12.48") 278 mm x 278 mm (10.95" x 10.95") cutout
Weight	14 kg, depending on configuration (30 lbs)
I/O Ports Standard	PC keyboard Connector (6 pin mini DIN type) - on front panel. May be used to connect to a QWERTY keyboard or to an ASCII Barcode Reader.
Environmental	
Temperature	*Operating:* 5 to 40°C (41 to104°F). *Storage*: -20 to 60°C (-4 to 158°F). *Relative Humidity*: 10 to 90%, non-condensing at 40°C.
Altitude	< 2000 meters
Installation Category	II
Pollution Degree	2
Power	Universal power supply, 100 to 240 Vac/dc, 100 VA max.
Fuse Rating	3.15 Amps, 250 Vac slow blow
Attributes	
Display	*Type*: Color LCD active matrix. *Screen Size*: 10.4" diagonal. *Resolution*: 640 x 480 pixels. *Update Rate*: 1 second. *Trend Timebase*: 5 min. to 24 hrs/screen; 0.5 cm/hr to 154 cm/hr vertical (0.2"/hr to 61"/hr vertical), 0.8 cm/hr to 250 cm/hr horizontal (0.3"/hr to 100"/hr horizontal).
Keys	16 membrane switches.
Data Archiving	*Media*: 100MB ZIP disk drive. *Data Types*: Analog points, calculations, discrete status, alarms, diagnostics. *Trends*: 4 max. (up to 12 points max. per trend) *Unit Data:* 1 (up to 12 points, 10,000 records) *Alarm History:* Up to 1600 records *Event History:* Up to 1600 records *Diagnostic History:* Up to 1600 records *Setpoint Programs:* 224 maximum on LS120 floppy disk. *Storage Rate Range*: 0.25 to 3600 sec. *Capacity*: Automatically calculates storage time based on storage rate.
Setpoint programmers	Up to 4

Table 1-1 Specifications (continued)

Program Capability	
Number of Programs	Memory can store 96 programs for a single channel programmer, 48 programs for a dual channel programmer, 32 programs for a three channel programmer, and 24 for a four channel programmer. Programs can also be stored to floppy disk. Programmer has ability to start a program at a predetermined time.
Number of Segments	63 segments per profile
Ramping Capability	Ramp X - Ramp rate is set by specifying x degrees per second, per minute, or per hour.
	Ramp T - Ramp rate is set by selecting the time to go from previous setpoint to next setpoint in t time.
	Ramp E - Ramp rate is set to increment by ΔSP for every pulse of a digital input.
	Value Duration Ramp - Ramp rate is based on the start value of the ramp and the time specified to reach the next soak start value.
Ramp Time Range	0-9,999,999 hours, minutes, or seconds.
Soak	Guaranteed or non-guaranteed. Can be applied to ramp or soak segment or across entire profile/program.
Soak time range	0-9,999,999 hours, minutes, or seconds.
Program Cycling	Entire programs or portions of a program can be cycled up to 99 times. Loops can be nested up to 4 deep.
Startup/Shutdown	Can be set up to use a predefined startup profile separate from the normal processing programs. Shutdown profile can be attached to the end of a profile and can be jumped to for emergency shutdown.
PV Hot Start	Can start the profile at the point where the present PV value first intersects the profile.
Batch Programming	1 to 255 Batch numbers. Batch number is assigned by the programmer and is incremented automatically when batch is started. Using a keyboard or bar code reader and the front keyboard connector, a batch can be labeled with a name of up to 8 characters.
Profile Events	Up to 16 events can be defined in each segment of a profile. Each event's state is activated at the beginning of the segment and is held throughout the segment.

Table 1-1 Specifications (continued)

Universal Analog Inputs		
Number	4 per module, up to 12 modules per video recorder	
Input Types	mV, V, mA, T/C, RTD, pyrometers	
Signal source	Thermocouple with cold junction compensation Line resistance up to 1000 ohms, T/C, mV, mA, V RTD, 3-wire connections, 40 ohms balanced maximum	
Input Impedance	10 megohms for T/C and mV inputs; >1 megohm for volt inputs	
Input Isolation	400 Vdc point-to-point 1350 Vac RMS A/D converter to logic	
Stray rejection	Series mode >60 dB. Common mode at 120 Vac >130 dB.	
Burnout	T/C, Pyrometry configurable to upscale, downscale or none. Linear types: none except following ranges: *Volt*: -500 to 500 mV; -1 to 1V; -2 to 2V; -5 to 5V; 0 to 10V; -10 to 10V; inherent to zero volt *RTD*: Inherent upscale *mA*: Inherent downscale	
T/C Break Detection	Via current pulse	
Scan rate	Fastest rate: 250 ms up to 4 inputs, 500 ms up to 12 inputs, 750 ms up to 16 inputs, 1s up to 24 inputs,1,5 s up to 28 inputs, 2 s up to 44 inputs, 3 s up to 48 inputs.	
A/D Converter Resolution	Better than 1 part in 50,000 at 50 Hz. Better than 1 part in 41,667 at 60 Hz.	
Analog Outputs		
Number	4 per module (non-isolated), up to 2 modules per video recorder (8 outputs)	
Type	Current output configurable within 0 to 20 mA. Maximum load 400 ohms per output. Voltage output configurable 0 to 5 V.	
Isolation from ground	350 Vac	
Accuracy	Factory configured accuracy = 0.1% at reference conditions Field calibration accuracy = 0.05%	
Temperature Effects	0.1% per 10°C in the rated limits	
D/A Resolution	16 bits	
Digital Inputs		
	AC Inputs	**DC Inputs**
Number	6 per module, up to 6 modules per video recorder	6 (sink/source) per module, up to 6 modules per video recorder
Input Voltage Range	80 to 264 Vac	10.2 to 26.4 Vdc
Peak Voltage	264 Vac	26.4 Vdc
AC Frequency	47 to 63 Hz	N/A
Isolation from ground	2300 Vac/1 min.	1100 Vac/1 min.
Isolation between inputs	350 Vac	30 Vac
ON Voltage Level	75 Vac minimum	9.5 Vdc minimum
OFF Voltage Level	20 Vac maximum	3.5 Vdc maximum

Table 1-1 Specifications (continued)

Input Impedance	51K	5.6K
Input Current	0.9 mA @ 100 Vac	1.1 mA @ 12 Vdc 3.2 mA @ 24 Vdc
Minimum ON Current	0.3 mA	0.3 mA
Maximum OFF Current	0.15 mA	0.2 mA
Base Power Required*	50 mA maximum	50 mA maximum
OFF to ON Response	5 to 30 ms	1 to 8 ms
ON to OFF Response	10 to 50 ms	1 to 8 ms
Logic Inputs		
Number	6 (dry contact) per module, up to 6 modules per video recorder	
Isolation from ground	2300 Vac/1 min.	
Switching Voltage	5 Vdc	
Switching Current	5 mA	
Digital Outputs		
	AC Outputs	**DC Outputs**
Number	6 per module, up to 6 modules per video recorder. Only 1-5 on each module can be configured as DAT outputs.	6 (current sinking) per module, up to 6 modules per video recorder. Only 1-5 on each module can be configured as DAT outputs.
Operating Voltage	15 to 264 Vac	10.2 to 26.4 Vdc
Output Type	SSR (Triac)	NPN open collector
Peak Voltage	264 Vac	40 Vdc
AC Frequency	47 to 63 Hz	N/A
Isolation from ground	2300 Vac/1 min.	1100 Vac/1 min.
Isolation between outputs	350 Vac	30 Vac
ON Voltage Drop	<1.5 Vac (>0.1A) <3.0 Vac (<0.1A)	1.5 Vdc maximum
Maximum Load Current	0.5A per point	0.3A per point
Maximum Leakage Current	4 mA (264 Vac, 60 Hz) 1.2 mA (100 Vac, 60 Hz) 0.9 mA (100 Vac, 50 Hz)	0.1 mA @ 40 Vdc
Maximum Inrush Current	10A for 10 ms	1A for 10 ms
Minimum Load	10 mA	0.5 mA
Base Power required*	20 mA/ ON pt. 250 mA maximum	120 mA maximum 5V
OFF to ON Response	1 ms	1 ms
ON to OFF Response	1 ms +1/2 cycle	1 ms
Fuses (European type 5 x 20mm)	1 per output, 1.0A slow blow	1 per output 1A fast blow
Relay (Alarm) Outputs		
Number	6 per module, up to 6 modules per video recorder. Only 1-5 on each module can be configured as DAT outputs.	
Contact Rating	2A, 250 Vac on resistive load	
Isolation from ground	2300 Vac/1 min.	
Isolation between outputs	2300 Vac/1 min.	
Contact Type	SPST normally open (NO), individually configurable to normally closed (NC) via jumper	

* Base Power Required is the power required to provided module operation within specifications.

Table 1-1 Specifications (continued)

Time Proportional Outputs (TPO) on digital output	
Time Resolution	Equals the Scan Cycle time of the recorder.
Module	Only Digital outputs 1 to 5 can be configured as DAT outputs.
Synchronization	Individual TPOs are not synchronized with others.
Performance/Capacities	
Math Calculations	Standard Math package includes: 24 Calculated Values along with the following Math functions: Free Form Math, Math Operators (+, -, x, ÷, Absolute Value, Square Root, Std. Deviation), Free Form Logic, Logic Operators (AND, OR, XOR, Inverter, Flip Flop, One-Shot), Inverter algorithms.
	Advanced Math package includes: 64 Calculated Values with the functions from Standard Math along with the following types of pre-packaged algorithms: Signal Select, Compare, Signal Clamp, Periodic Timer, Interval Timer, Counter, Relative Humidity, Standard Splitter, Scaling.
Constants	32
Alarms	96
Totalizers	0, 4 or 48
Control Loops	Up to 8 (PID, ON/OFF, Cascade, Split, Ratio).
Auto Tune	Each loop can be pre-tuned automatically to establish acceptable tuning parameters. On-line fuzzy overshoot suppression.
Primary Displays	Up to 10 displays may be assigned from the 32 formats selected among trend screens, Bargraph screens, Panel screens, Summary screens, loop screens, Setpoint profiler screens.
Support Displays	13 (menu access).
Communications (optional)	*Type:* RS-422/485, Modbus™ RTU protocol *Connection:* 2 or 4 wire RS485. *Distance:* 600 meters, (2000 feet). *Number of links:* Up to 30 *Baud Rate:* 1200, 2400, 4800, 9600, 19.2K, 38.4K. *Parity*: Selectable; odd, even, none.

Table 1-1 Specifications (continued)

Analog input accuracy and rated limits			
Accuracy	*Reference conditions*	Temperature = 23°C ± 2°C (73°F ± 3°F) Humidity = 65% RH ± 5% Line voltage = Nominal ± 1% Source resistance = 0 ohm Series mode and common mode = 0 V Frequency = Nominal ± 1%	
	Accuracy	Field calibration accuracy 0.05% of the selected range (IEC 873) Factory calibration: 0.1% Cold junction accuracy: ± 0.5°C	
Rated limits and associated drifts	**Parameters**	**Rated limits**	**Influence on accuracy**
	Temperature	0 to 50°C (32 to 120 °F)	0.15% per 10°C of change (See Note A) Cold junction 0.3°C/10°C
	Supply voltage	85 to 250 V	No influence
	Source resistance	T/C, mV	6 µV per 400 Ohms of line resistance max. = 1000 Ohms
		RTD	0.1°C per Ohm in each wire balanced leads 40 Ohms max. (from 0 to 400°C)
	Humidity	10 to 90% RH at 25°C	0.1% max.
	Long-term stability		0.1% per year

Table 1-2 Analog Input Accuracy--Linear types

Millivolts	Volts	Current	Ohms
0 to 10 mV -10, +10 mV 0 to 20 mV -20, 0, +20 mV 0, 50 mV -50, 0, +50 mV 10 to 50 mV 0 to 100 mV -100, 0, +100 mV 0 to 500 mV -500, 0, +500 mV	0 to 1 V -1, 0, 1 V 0 to 2 V -2, 0, +2 V 0 to 5 V -5, 0, +5 V 1 to 5 V 0 to 10 V -10, 0, +10 V	0, 20 mA 4, 20 mA	0 to 200 0 to 2000
NOTE: - The mA inputs must be connected to a 250 ohms resistor across the input terminals.			

Table 1-3 Analog Input --Non-linear types

Thermocouples -ITS-90 except where noted							
Type	Operating span		Accuracy (1)				
			% Range	Min value		Reference range (2)	
	°F	°C		°F	°C	°F	°C
J	0 to 2190	-18 to 1199	0.1	0.4	0.2		
K	0 to 2500	-18 to 1371	0.1	0.4	0.2		
E	-450 to 1830	-268 to 999	0.1	0.4	0.2		
T	-300 to 752	-184 to 400	0.1	0.4	0.2		
N	0 to 2372	-18 to 1300	0.1	0.6	0.3		
B	110 to 3300	43 to 1816	0.1	2.5	1.4	752 to 3300	400 to 1816
R	0 to 3210	-18 to 1766	0.1	1.5	0.8		
S	0 to 3210	-18 to 1766	0.1	1.6	0.9		
W5/W26 **(3)**	0 to 4200	-18 to 2316	0.1	0.9	0.5	32 to 3272	0 to 1800
PLAT II **(3)**	-100 to 2500	-73 to 1371	0.1	0.4	0.2		
NI-NIMO	32 to 2502	0 to 1372	0.1	0.4	0.2		
RTD (4)							
CU10	-100 to 310	-73 to 154	0.5	2.5	1.4		
PT100 IEC	-300 to 1570	-184 to 854	0.1	0.5	0.3		

Pyrometry (Rayotube & Spectray) Types								
Type	Operating span		Accuracy (5)					
			Max value		Min value			
	°F	°C	°F	°C	°F	°C		
18890-0035	1200 to 2600	649 to 1426	4	2	1	0.6		
18890-0073	800 to 1800	427 to 982	12.5	7	1	0.6		
18890-0074	1100 to 2300	594 to 1260	3	1.7	1	0.6		
18890-0075	1500 to 3300	816 to 1815	6	3	1.8	1		
18890-0163	200 to 1000	94 to 537	11	6	1.5	0.8		
18890-0216	2110 to 4600	1155 to 2537	8	4.4	1.8	1		
18890-0412	1375 to 3000	747 to 1648	10	5.6	1.3	0.7		
18890-00643	1850 to 4000	1010 to 2204	8	4.4	1	0.6		
18890-1729	1650 to 3600	899 to 1982	5	3	1.5	0.8		
18890-3302	750 to 1600	399 to 871	6	3	1	0.6		
18890-5423	2210 to 5000	1210 to 2760	18	10	2	1.1		
18894-0579	752 to 2552	400 to 1400	33	18	3.6	2		
18899-8814	340 to 1800	172 to 982	11	6	2	1.1		
18894-9014	752 to 2552	400 to 1400	20	11	2.6	1.4		
Spectray 18885	1832 to 3452	1000 to 1900	30	17	0.6	0.3		
Spectray 18885-1	1292 to 2912	700 to 1600	60	33	0.6	0.3		
Spectray 18885-2	806 to 1400	430 to 760	38	21	0.2	0.1		
Spectray 18886	1833 to 3452	1001 to 1900	20	11	0.6	0.3		
Spectray 18886-1	1292 to 2912	700 to 1600	80	44	0.6	0.3		
18874-0578	752 to 2552	400 to 1400	3.6	2	1.8	1		
18875-0579	752 to 2552	400 to 1400	3.6	2	1.8	1		

NOTES:
1: The accuracy will be the larger value between Min Value and %range of the selected limits
2: Reference range = operating range when blank
3: IPTS-68
4: T° influence: 0.5% per 10°C on Cu 10 ohms, 0.3% per 10°C on Pt 100 ≤ 200°C
5: For Pyrometry, the worst accuracy (Max value) is at the low range limit , the best (Min value) is at the high limit.
- For non linear temperature transmitter, the transmitter range MUST be identical to the input range of the recorder.

Table 1-4 Standards

This product is designed and manufactured to be in conformity with applicable U.S., Canadian, and International (IEC/CENELEC/CE) standards for intended instrument locations. The following Standards and Specifications are met or exceeded.

Case Protection	IP55 on front door only, when the instrument is panel mounted and the front door securely closed.
Rear of Panel	EN 60529, IP 20
Flammability Rating	UL 94 - V2
Vibration Level	10 to 40 Hz, 0.07 mm displacement; 40 to 60 Hz, 0.2g acceleration
Electromagnetic Compatibility	CE EMC Directive 89/336/EEC
Safety	IEC1010 Installation Category II for personal protection
Intended Instrument Locations	Rack or panel mounting in control room or industrial environments (operator accessibility front of panel only) Installation Category II with grounded mains supply from isolation transformer or GFI (ground fault interrupter) Pollution Degree 2 with rear of panel enclosed, in industrial environment

1.3 Model Selection Guide

This table helps you to identify correctly the unit in front of you. Please refer to the product label and verify that you have the right unit.

Select the desired key number. The mark to the right shows the selection available. A complete model number has the requested number of digits from each table as follows.

Video Recorder Model Number **Figure 1-2 Video Recorder Model Number**

Instructions

- Make the desired selection from Tables I to VI .
  The arrow to the right marks the selection available.
  A dot (•) denotes unrestricted availability.

Key Number		I		II		III		IV		V		VI
VRX180	-	_ _	-	_ _ _ _ _ _	-	_ _ _ _ _	-	_	-	_ _ _ _ _	-	_ _

KEY NUMBER Description		Selection	Availability
Video Recorder		VRX180	↓
TABLE I - ANALOG INPUTS			
Analog Universal Inputs (slot A to F)	4 Universal Analog Inputs	04	•
	8 Universal Analog Inputs	08	•
	12 Universal Analog Inputs	12	•
	16 Universal Analog Inputs	16	•
	20 Universal Analog Inputs	20	•
	24 Universal Analog Inputs	24	•
TABLE II - ADDITIONAL INPUTS AND OUTPUTS			
Slot J	None	0 _ _ _ _ _	•
	4 Universal Analog Inputs	A _ _ _ _ _	•
	6 Digital Inputs (contact closure)	B _ _ _ _ _	•
	6 Digital Inputs 24 Vdc	C _ _ _ _ _	•
	6 Digital Inputs 120 / 240 Vac	E _ _ _ _ _	•
	6 Relays Outputs	R _ _ _ _ _	•
	6 Digital Outputs 24 Vdc (open collector)	G _ _ _ _ _	•
	6 Digital Outputs 120 / 240 Vac (triac)	H _ _ _ _ _	•
Slot K	None	_0 _ _ _ _	•
	4 Universal Analog Inputs	_A _ _ _ _	•
	6 Digital Inputs (contact closure)	_B_ _ _ _	•
	6 Digital Inputs 24 Vdc	_C_ _ _ _	•
	6 Digital Inputs 120 / 240 Vac	_E_ _ _ _	•
	6 Relays Outputs	_R_ _ _ _	•
	6 Digital Outputs 24 Vdc (open collector)	_G_ _ _ _	•
	6 Digital Outputs 120 / 240 Vac (triac)	_H_ _ _ _	•
Slot L	None	_ _ 0 _ _ _	•
	4 Universal Analog Inputs	_ _ A _ _ _	•
	6 Digital Inputs (contact closure)	_ _ B _ _ _	•
	6 Digital Inputs 24 Vdc	_ _ C _ _ _	•
	6 Digital Inputs 120 / 240 Vac	_ _ E _ _ _	•
	6 Relays Outputs	_ _ R _ _ _	•
	6 Digital Outputs 24 Vdc (open collector)	_ _ G _ _ _	•
	6 Digital Outputs 120 / 240 Vac (triac)	_ _ H _ _ _	•
Slot M	None	_ _ _ 0 _ _	•
	4 Universal Analog Inputs	_ _ _ A _ _	•
	6 Digital Inputs (contact closure)	_ _ _ B _ _	•
	6 Digital Inputs 24 Vdc	_ _ _ C _ _	•
	6 Digital Inputs 120 / 240 Vac	_ _ _ E _ _	•
	6 Relays Outputs	_ _ _ R _ _	•
	6 Digital Outputs 24 Vdc (open collector)	_ _ _ G _ _	•
	6 Digital Outputs 120 / 240 Vac (triac)	_ _ _ H _ _	•

Model Selection Guide (cont.)

TABLE II - ADDITIONAL INPUTS AND OUTPUTS (continued)		VRX180 Selection	
Slot N	None	_ _ _ _ 0 _	•
	4 Universal Analog Inputs	_ _ _ _ A _	•
	6 Digital Inputs (contact closure)	_ _ _ _ B _	•
	6 Digital Inputs 24 Vdc	_ _ _ _ C _	•
	6 Digital Inputs 120 / 240 Vac	_ _ _ _ E _	•
	6 Relays Outputs	_ _ _ _ R _	•
	6 Digital Outputs 24 Vdc (open collector)	_ _ _ _ G _	•
	6 Digital Outputs 120 / 240 Vac (triac)	_ _ _ _ H _	•
	4 Current Outputs **(Note 7)**	_ _ _ _ M _	•
Slot P	None	_ _ _ _ _ 0	•
	4 Universal Analog Inputs	_ _ _ _ _ A	•
	6 Digital Inputs (contact closure)	_ _ _ _ _ B	•
	6 Digital Inputs 24 Vdc	_ _ _ _ _ C	•
	6 Digital Inputs 120 / 240 Vac	_ _ _ _ _ E	•
	6 Relays Outputs	_ _ _ _ _ R	•
	6 Digital Outputs 24 Vdc (open collector)	_ _ _ _ _ G	•
	6 Digital Outputs 120 / 240 Vac (triac)	_ _ _ _ _ H	•
	4 Current Outputs	_ _ _ _ _ M	•
TABLE III - FIRMWARE - DATA STORAGE			
Control Loops **(Notes 1, 5)**	None	0 _ _ _ _	•
	1 Control Loop	1 _ _ _ _	•
	2 Control Loops	2 _ _ _ _	•
	4 Control Loops	4 _ _ _ _	•
	6 Control Loops	6 _ _ _ _	•
	8 Control Loops	8 _ _ _ _	•
Set Point Programs **(Note 4)**	None	_ 0 _ _ _	•
	1 Set Point Program	_ 1 _ _ _	•
	2 Set Point Programs	_ 2 _ _ _	•
	3 Set Point Programs	_ 3 _ _ _	•
	4 Set Point Programs	_ 4 _ _ _	•
Math **(Note 2)**	Standard Math	_ _ 0 _ _	•
	Advance Math	_ _ 1 _ _	•
	Advance Math and 4 Totalizers	_ _ 2 _ _	•
	Advance Math and 48 Totalizers	_ _ 3 _ _	•
Data storage **(Note 6)**	100 Mb ZIP Drive	_ _ _ 2 _	•
Other	None	_ _ _ _ 0	•
TABLE IV - COMMUNICATION			
Communication	None	0	•
	RS485 - Modbus RTU	C	•
	Ethernet Interface	E	**c**
TABLE V - OPTIONS			
Documentation (prompts language, manual)	English	E _ _ _ _ _	•
	French	F _ _ _ _ _	•
	German	G _ _ _ _ _	•
	Italian	I _ _ _ _ _	
	Spanish	S _ _ _ _ _	
	English - (U.S. format)	U	•
Certificates	None	_ 0 _ _ _ _	•
	Certificate of Conformance	_ B _ _ _ _	•
	Calibration Certificate **(Note 3)**	_ C _ _ _ _	•
	Calibration and Conformance Certificates **(Note 3)**	_ E _ _ _ _	•
Tagging	None	_ _ 0 _ _ _	•
	Linen	_ _ L _ _ _	•
	Stainless steel	_ _ S _ _ _	•

Model Selection Guide (cont.)

TABLE V - OPTIONS (continued)		VRX180 Selection	
Approvals	CE Mark Compliant	_ _ _ 0 _ _	•
	CSA/NRTLc/CE Mark	_ _ _ C _ _	•
Software	None	_ _ _ _ 0 _	•
	SDA and SCF	_ _ _ _ B _	•
	SCF (Configuration Software)	_ _ _ _ C _	•
	SDA (Data Analysis Software)	_ _ _ _ E _	•
Case	Galvanized Case, Grey Door, Glass Window, Latch	_ _ _ _ _ 0	•
	Galvanized Case, Grey Door, Glass Window, Key Lock	_ _ _ _ _ 1	•
	Galvanized Case, Grey Door, Plastic Window, Latch	_ _ _ _ _ 2	•
	Galvanized Case, Grey Door, Plastic Window, Key Lock	_ _ _ _ _ 3	•
	Portable Case (Painted Case, Handles)	_ _ _ _ _ 6	•

TABLE VI		
Factory Use Only	00	•

SOFTWARES AND SUPPORT PARTS	Part #	
SDA Data Analysis Software (can be ordered separately if not selected in Table V)	045501	•
SCF Configuration Software (can be ordered separately if not selected in Table V)	045502	•
SDI Disk Initialization Software **(Note 6)**	46193351-501	•
Kit of 4 resistors 250 Ohms for 4-20 mA input	46181080-503	•

RESTRICTIONS

Restriction Letter	Available With		Not Available With	
	Table	Selection	Table	Selection
c			II	_ _ _ _ _ A, _ _ _ _ _ B, _ _ _ _ _ C, _ _ _ _ _ E, _ _ _ _ _ R, _ _ _ _ _ G, _ _ _ _ _ H, _ _ _ _ _ M

Notes:

1. The available algorithms include: PID (standard and advance), Cascade, Split Output and On/Off.
   The appropriate outputs from Table I must be specified - Current or Relays.
   If Split (Duplex) output Control is required, advance math must be selected (Table III).
2. Standard Math includes 24 Calculated Values and the following pre-packaged algorithms

Free Form Math	Logic Operators	Flip-Flop/One Shot	Periodic Timer
Free Form Logic	Math Operators	Invertor	

   Advance Math includes 64 Calculated Values and the following additional of pre-package algorithms.

Signal Select	Interval Timer	Counter
Compare	Relative Humidity	Scaling
Signal Clamp	Mass Flow	Advanced Splitter
Peak Picking	Fo Calculation	Continuous Emissions Monitoring
Function Generator	Multiple Input Average	- CEM Block Average
Carbon Potential	Single Point Average	- CEM Rolling Average
Rolling Average	Standard Splitter	
3. Customer must supply Input Actuation Type and Range for each input for inclusion in the free form section of the Factory order to supply the Custom Calibration Certificate, otherwise the calibration will be based on the factory default ranges.
4. When selecting SP program make sure to select analog output (current) as necessary (Table II slot N,P).
5. When selecting Control loops, make sure to select outputs (as necessary in Table II)
6. Provided with each VRX180 are : one pre-initialized disk and one SDI software pack.
   SDI software should be installed on a PC and used for initialization of new disks.
7. Must purchase Table II _ _ _ _ M _ in order to select Table II Selection _ _ _ _ _ M.

2. Installation

What's in this section?

The following topics are covered in this section.

NOTICE

If this instrument is used in a manner not specified by the manufacturer, the protection provided by the instrument may be impaired.

2.1 Warning

To avoid the risk of electrical shock which could cause personal injury, follow all safety notices in this documentation.

Protective earth terminal. Provided for connection of the protective earth supply system conductor.

- POWER SUPPLY
  Ensure the source voltage matches the supply voltage of the video recorder before power on. (In the rear of the video recorder, near to the connector of the power supply)
- PROTECTIVE GROUNDING
  Make sure to connect the protective grounding to prevent an electric shock before power on. Do not operate the instrument when protective grounding or fuse might be defective. To avoid a potential shock hazard, never cut off the internal or external protective grounding wire or disconnect the wiring of protective grounding terminal.
- FUSE
  To prevent a fire, make sure to use the appropriate fuse (current, voltage, type). Before replacing the fuse, turn off the power and disconnect the power source. Do not use a different fuse or short-circuit the fuse holder.
- DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE
  Do not operate the instrument in the presence of flammable liquids or vapors. Operation of any electrical instrument in such an environment constitutes a safety hazard.
- NEVER TOUCH THE INTERIOR OF THE INSTRUMENT
  Inside this instrument, there are areas of high voltage; therefore, never touch the interior if the power is connected. This instrument has an internal changeable system; however, internal inspection and adjustments should be done by qualified personnel only.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- Do not replace any component (or part) not explicitly specified as replaceable by your supplier.
- INSTALL INDOOR ONLY.

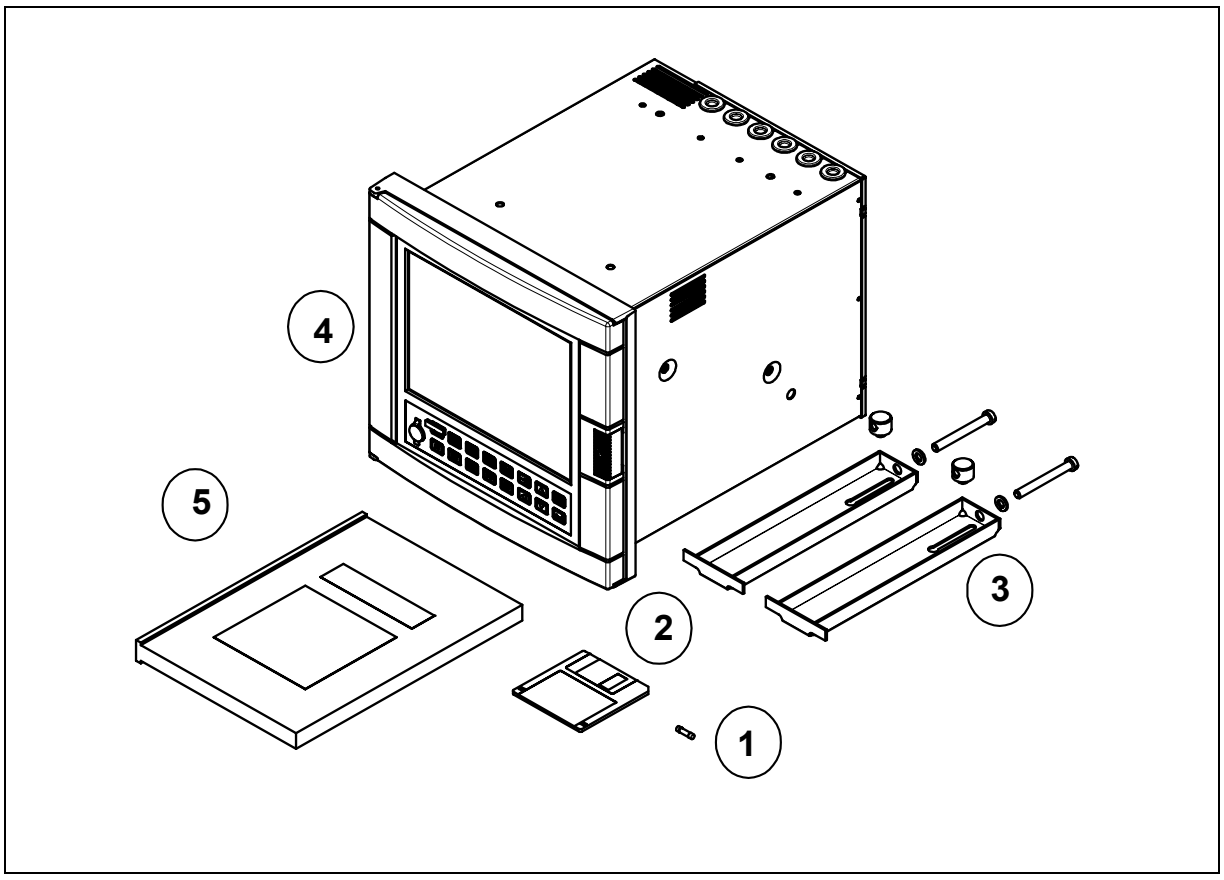
2.2 Unpacking

Examine the shipping container carefully. If there are visible signs of damage, notify the carrier and your local sales office immediately.

If there is no visible damage, compare the contents with the packing list. Notify your local sales office if there is equipment shortage.

To obtain proper credit and to avoid delays, return goods only after contacting your local sales office in advance.

Carefully remove the instrument and remove any shipping ties or packing material. Follow the instructions on any attached tags or labels and then remove such tags or labels.



1. Fuse (spare) use only 3.15 AT (slow blow) fuses size 5 x 20 mm
2. Floppy disk
3. Mounting brackets with nuts
4. Video recorder
5. Product manual

NOTE: In the event that any items are missing, please contact your nearest sales office.

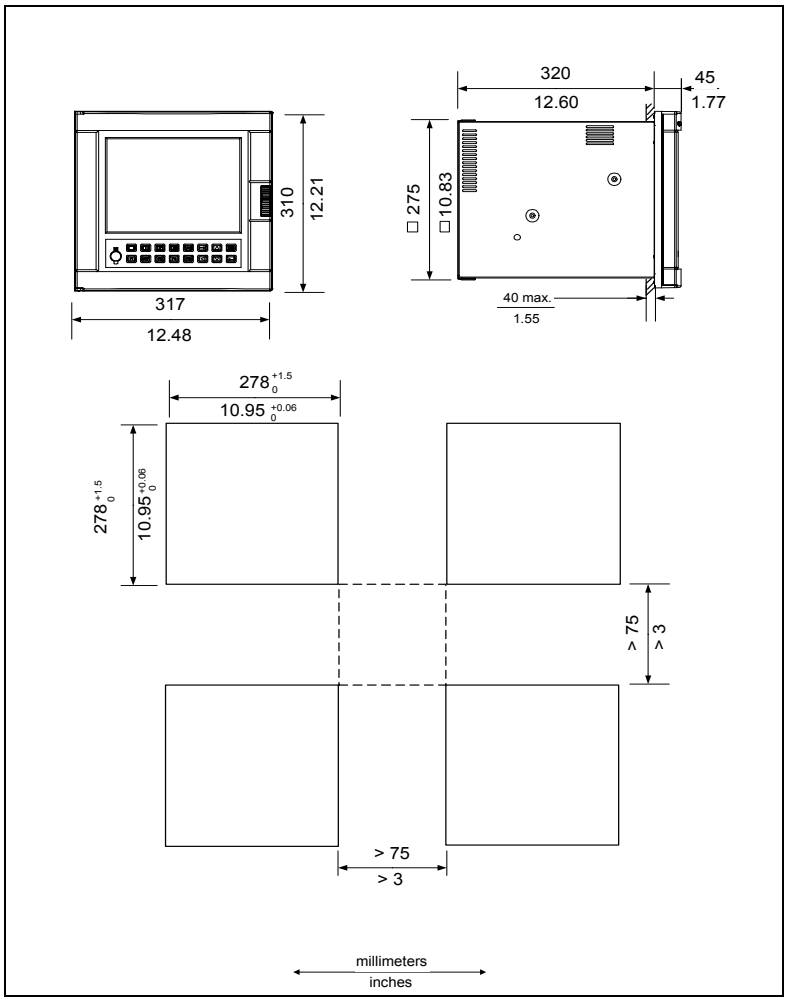
2.3 Panel mounting the video recorder

2.3.1 Recommendations

This video recorder is designed to operate under specific conditions. If you need more information, refer to the product specification sheet.

2.3.2 External dimensions and cut-out

Prepare panel cut-out as detailed below:



NOTE: Maximum panel thickness 40 mm (1.55")

CAUTION

The maximum temperature inside the cabinet should not exceed the ambient conditions specific for the video recorders.
The video recorder must be mounted into a panel to limit operator access to the rear terminals.

Failure to comply with these instructions may result in product damage.

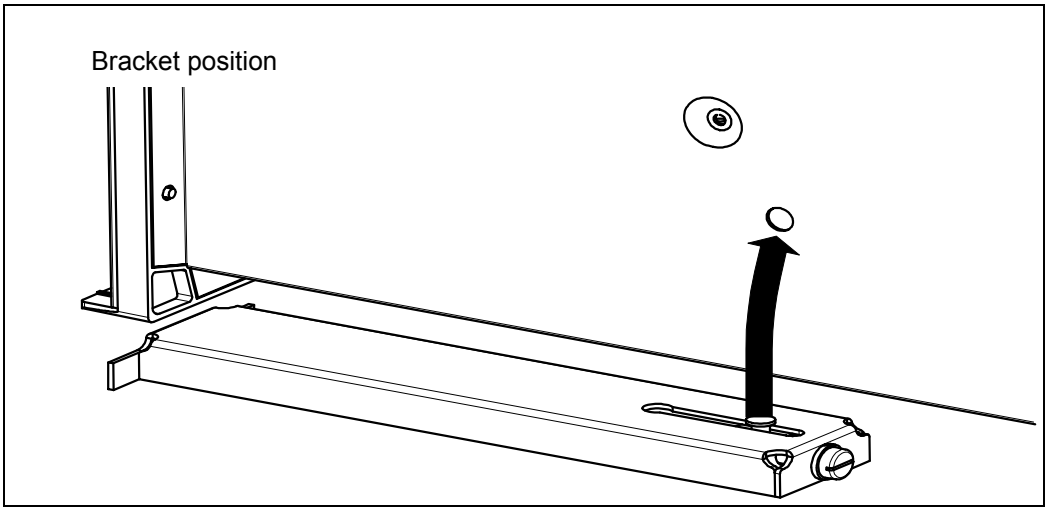
2.3.3 Installing the video recorder

To install the video recorder, follow the figure below:

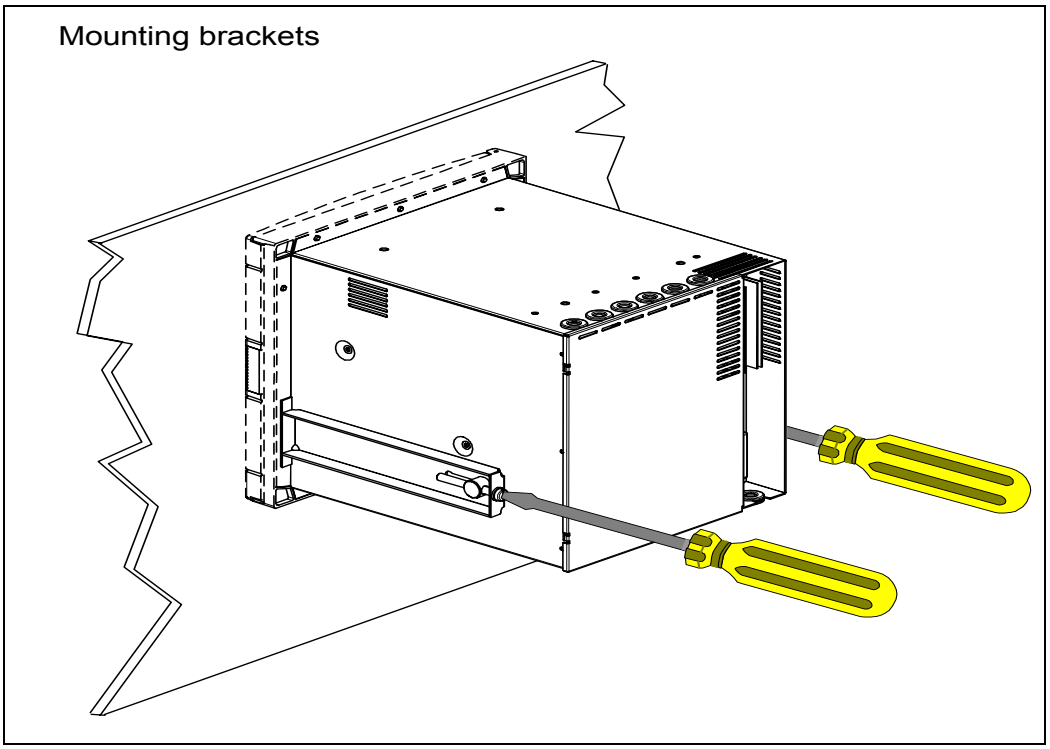
Step 1: Remove rear cover and wire access holes

Step 2: Insert video recorder through the panel cutout

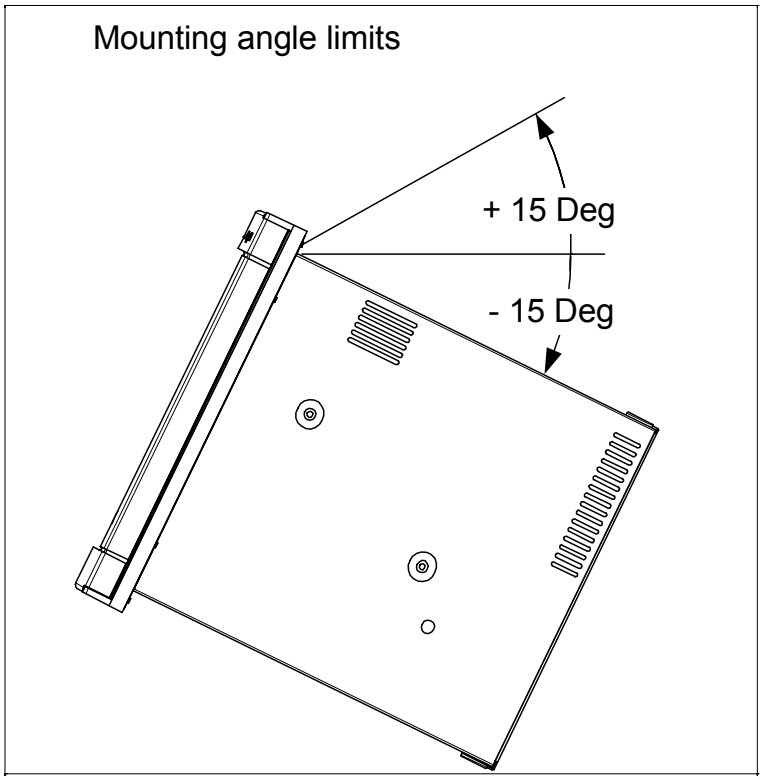
Step 3: Attach mounting brackets to the sides of the video recorder



Step 4: Tighten the mounting screws



NOTE: When installing the video recorder, the following limits should be respected:



2.4 Wiring the video recorder

2.4.1 Recommendations

⚠ CAUTION

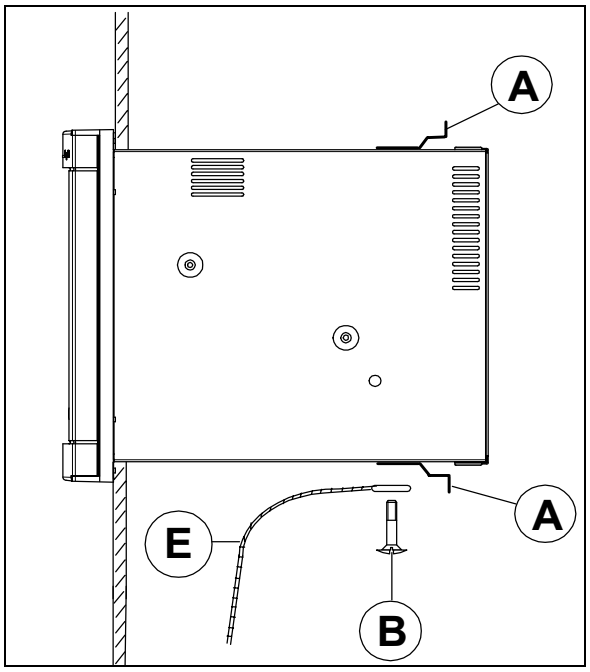
- All wiring must be in accordance with local electrical codes and should be carried out by authorized and experienced personnel.
- The ground terminal must be connected before any other wiring (and disconnected last).
- A switch in the main supply is mandatory near the equipment.
- If an external fuse is used to protect the electrical circuit to the video recorder, the fuse should match the video recorder fuse rating (fuse type) as well as for the fuseholder.
- Sensor wiring should be run as far as possible from power wiring. (motors, contactors, alarms, etc.)
- To reduce stray pick-up, we recommend the use of a twisted pair sensor wiring.
- EMI effects can be further reduced by the use of shielded cable sensor wiring. The shield must be connected to the ground terminal.

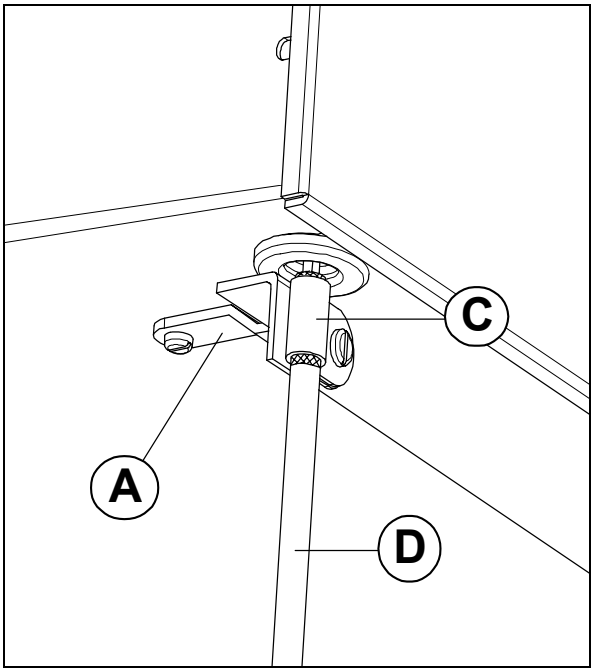
Failure to comply with these instructions may result in product damage.

- EXAMPLE:

Rep. A: Cable retaining bracket (46210075-501)
Rep. B: Grounding screw
Rep. C: Clamp
Rep. D: Shielded cable (inputs)
Rep. E: External grounding cable

- The use of spade terminals on all wiring is recommended.

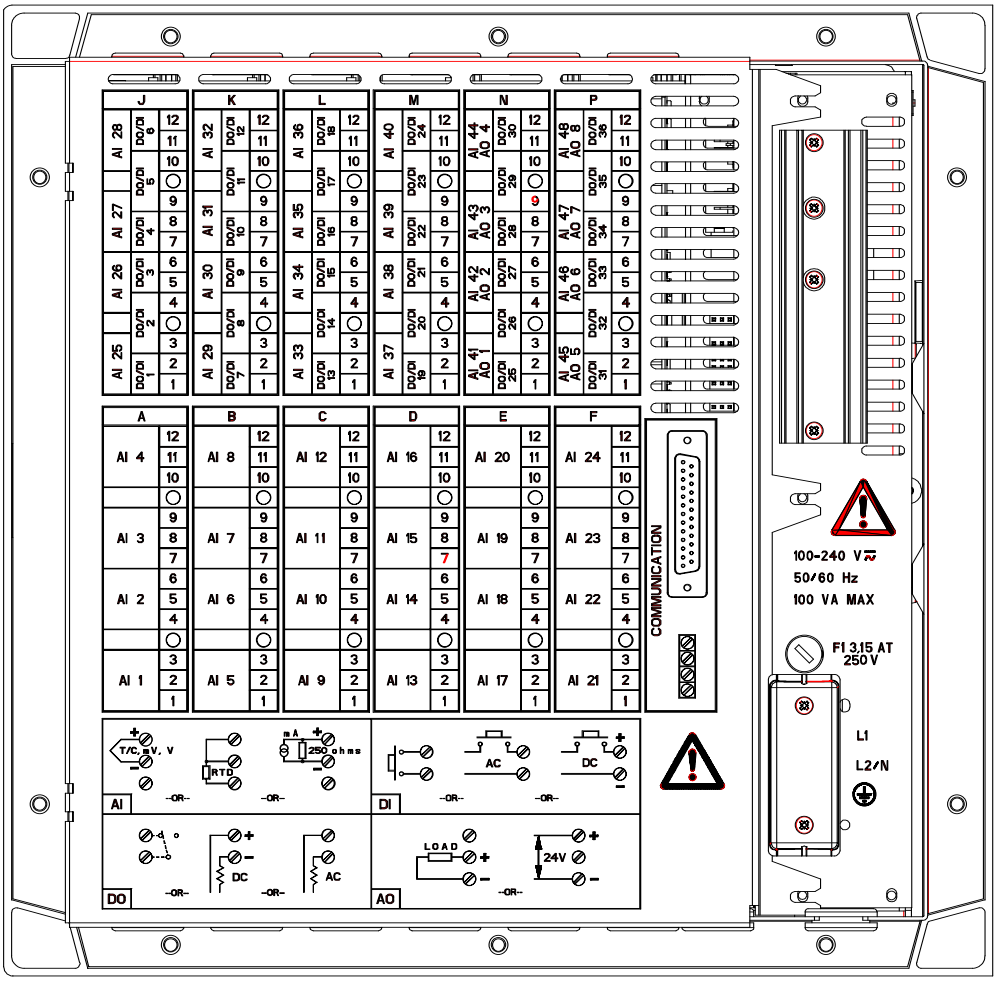




2.5 Terminal connections

2.5.1 Rear cover

The rear cover protects the I/O boards terminal connectors. On the rear cover, a drawing reminds the user of the terminals use.

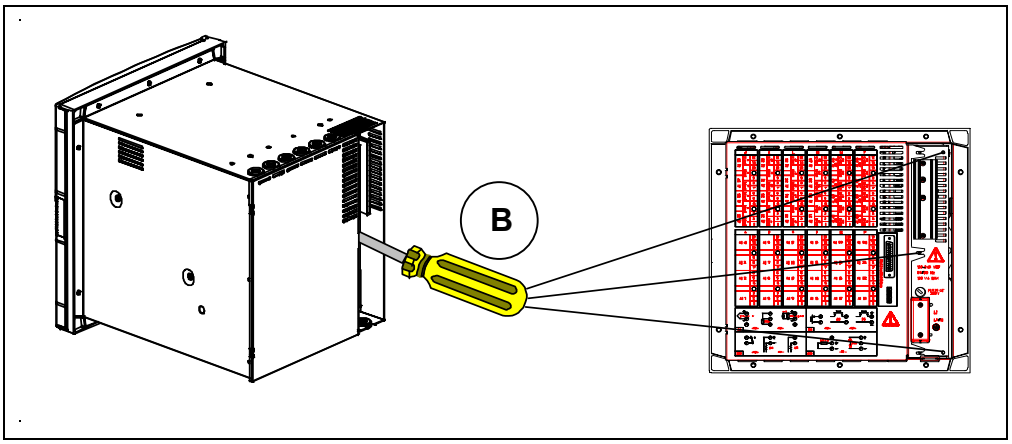


	Positions
AI = Analog input **AO** = Analog output **DI** = Digital input **DO** = Digital output (relay)	From **A** to **F** + **J** to **P** (Upper and lower rack) From **N** to **P** (Upper rack) From **J** to **P** (Upper rack) From **J** to **P** (Upper rack)

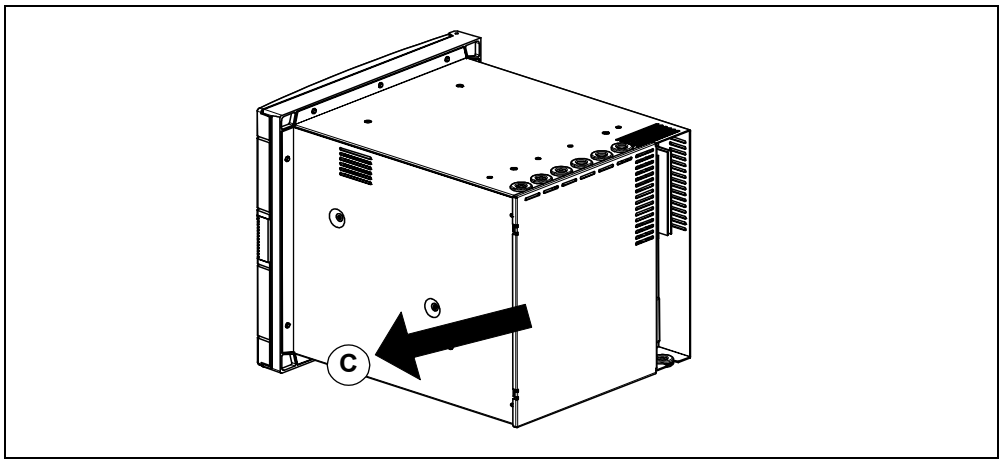
Note: Terminal blocks can be removed from the board for easier wiring and board replacement.

Removing the rear cover grants access to the terminals location:

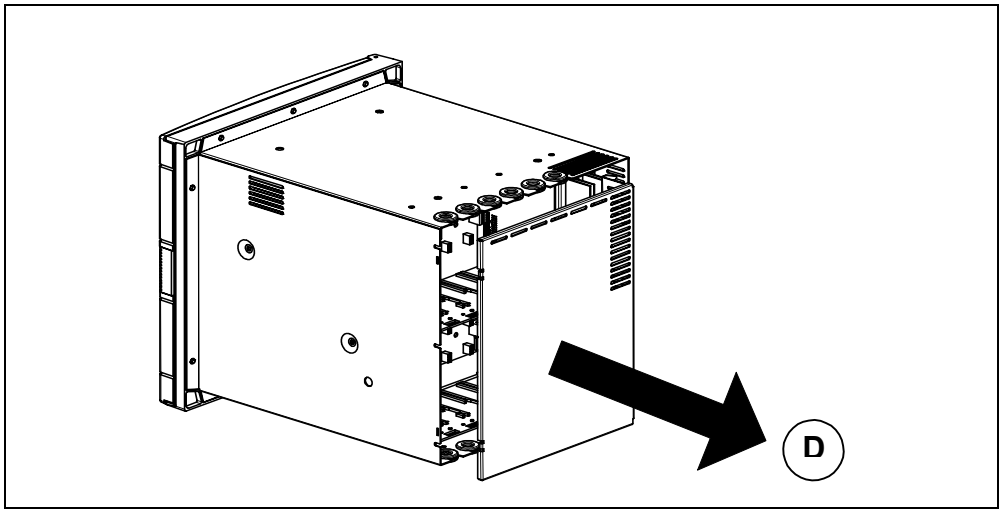
Step A: Turn off power
Step B: Loosen screws holding rear cover



Step C: Slide rear cover to the left



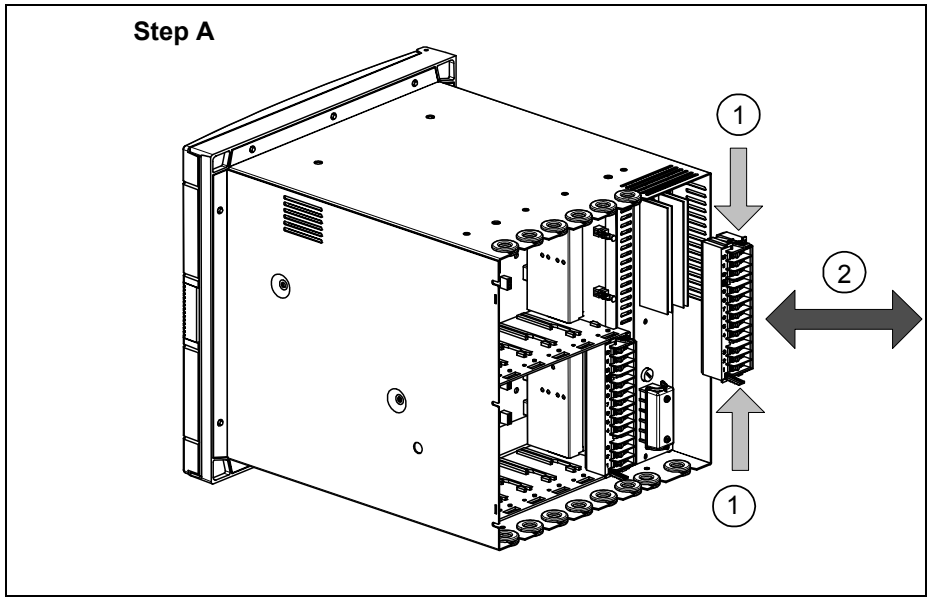
Step D: Remove rear cover



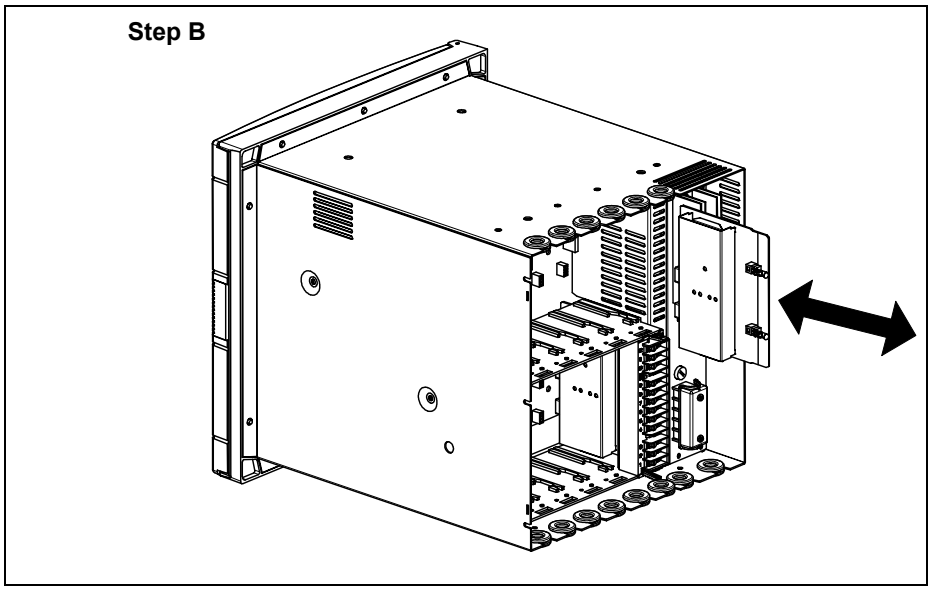
2.5.2 Inserting and extracting inputs and outputs board:

Steps A and B show how to insert or extract a board from the video recorder.

To extract a board: Step A then Step B.
To insert a board: Step B then Step A.



(1) Press down on terminal block clips
(2) Push in or pull out to insert or remove from board



Push in or pull out on the board to insert or remove from video recorder

2.5.3 Analog input boards

A universal Analog Input board accepts a variety of input signals from field devices. Figure 2-1 illustrates the terminal block connections for the various inputs. One AI board can be configured to accept multiple input types.

Table 2-1 Universal Analog Input Board Specifications

Specification	Description
Input Types	mV, V, mA, T/C, RTD, and Ohms
Number of Inputs	4 per board, up to 12 boards per video recorder (48 inputs)
Signal Source	Thermocouple with cold junction compensation, for operation between 0 to 80º C (32 to 176º F) Line resistance up to 1000 ohms, T/C, mV, mA, V RTD, 3-wire connections, 40 ohms balanced max.
Input Impedance	10 Meg Ω for T/C, mV inputs, > 1 Meg Ω for volt inputs

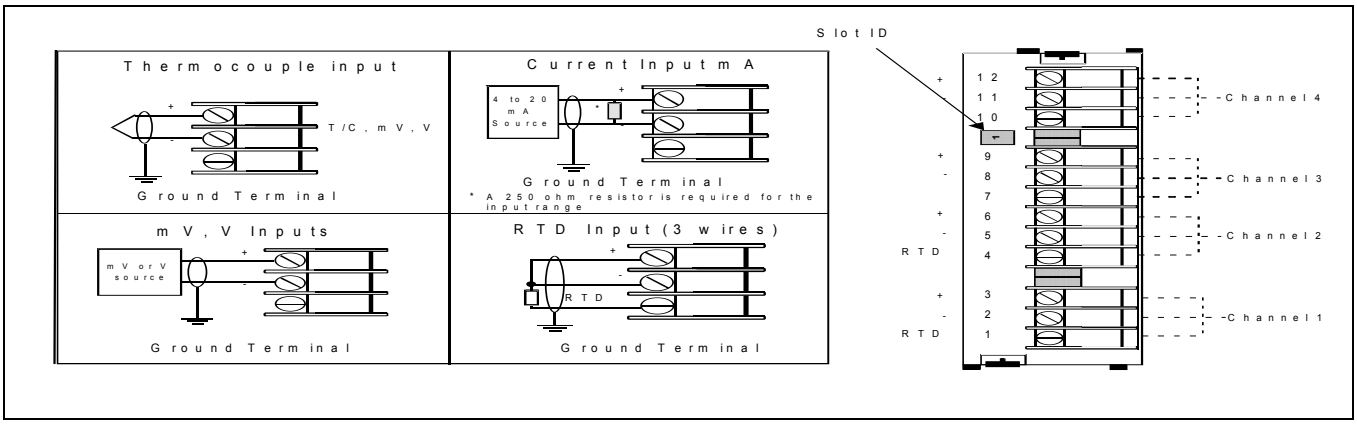


Figure 2-1 AI Board Terminal Block Connections

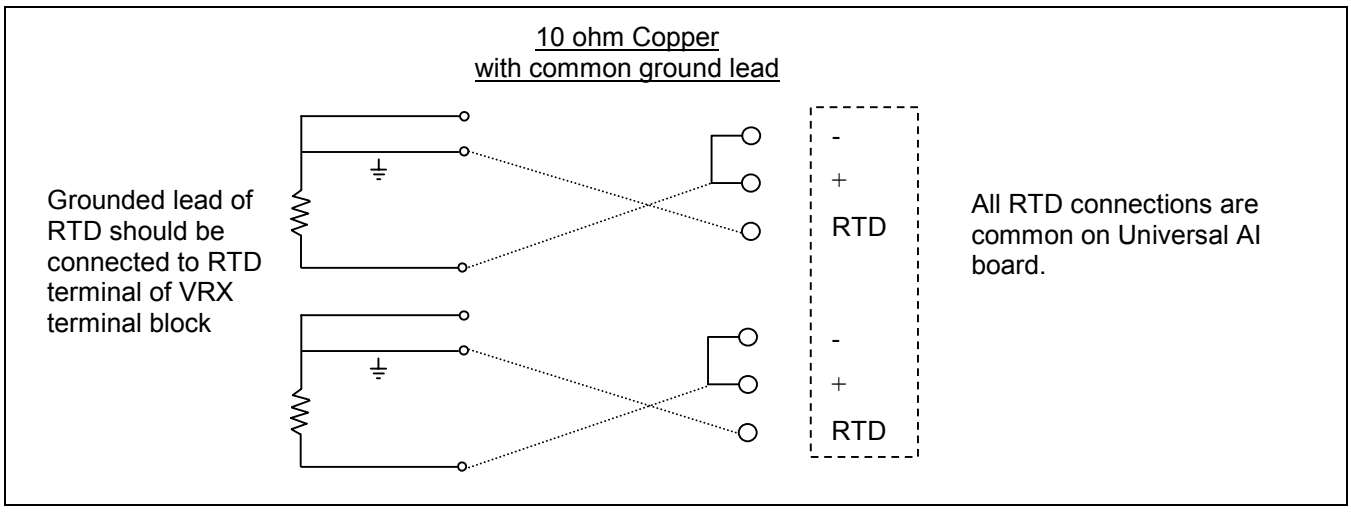


Figure 2-2 10 ohm Copper connections

2.5.4 Digital Inputs Boards

Three types of Digital Input (DI) boards accept three types of input signals.

1. Logic Input
2. DC Input
3. AC Input

Each type is described on the following pages. Figure 2-3 shows the terminal block connections for all DI boards. See Section 1 for details on all I/O board specifications.

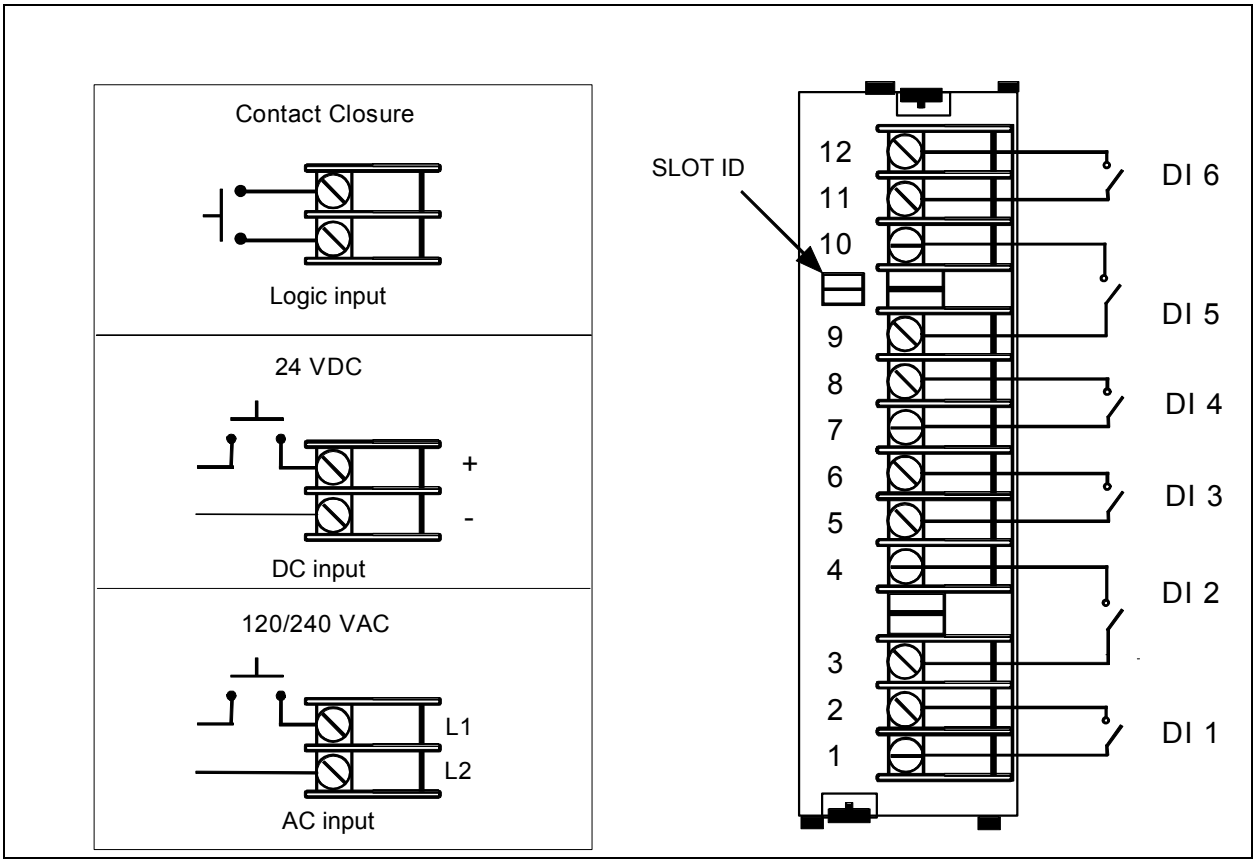
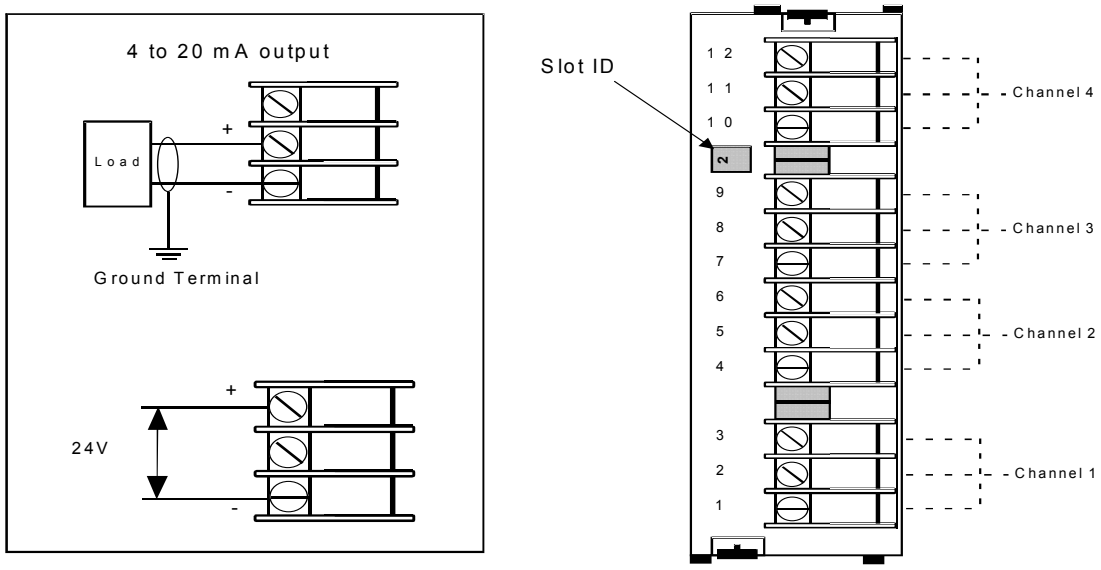


Figure 2-3 DI Board Terminal Block Connections

2.5.5 Analog Outputs

The Analog Output (AO) board provides four outputs at 0 to 20 mA (configurable for 4 to 20 mA or any span between 0 to 20 mA). When not used for an analog output, an output channel may be used to power a transmitter with 24 Vdc power. The video recorder will support up to two AO boards, for a total of eight outputs. Figure 2-4 shows the terminal connections for the AO board. See Section 1 for details on all I/O board specifications.



NOTE - Channels not used as analog outputs can be used to supply a transmitter with 24 Vdc power.

Figure 2-4 AO Board Terminal Block Connections

2.5.6 Digital Outputs

There are three types of Digital Output (DO) boards which provide three types of Off/On control.

1. Relay (alarm) Output
2. DC Output
3. AC output

Figure 2-4 shows the terminal block connections for the DC output and AC output DO boards. See Section 1 for details on all I/O board specifications.

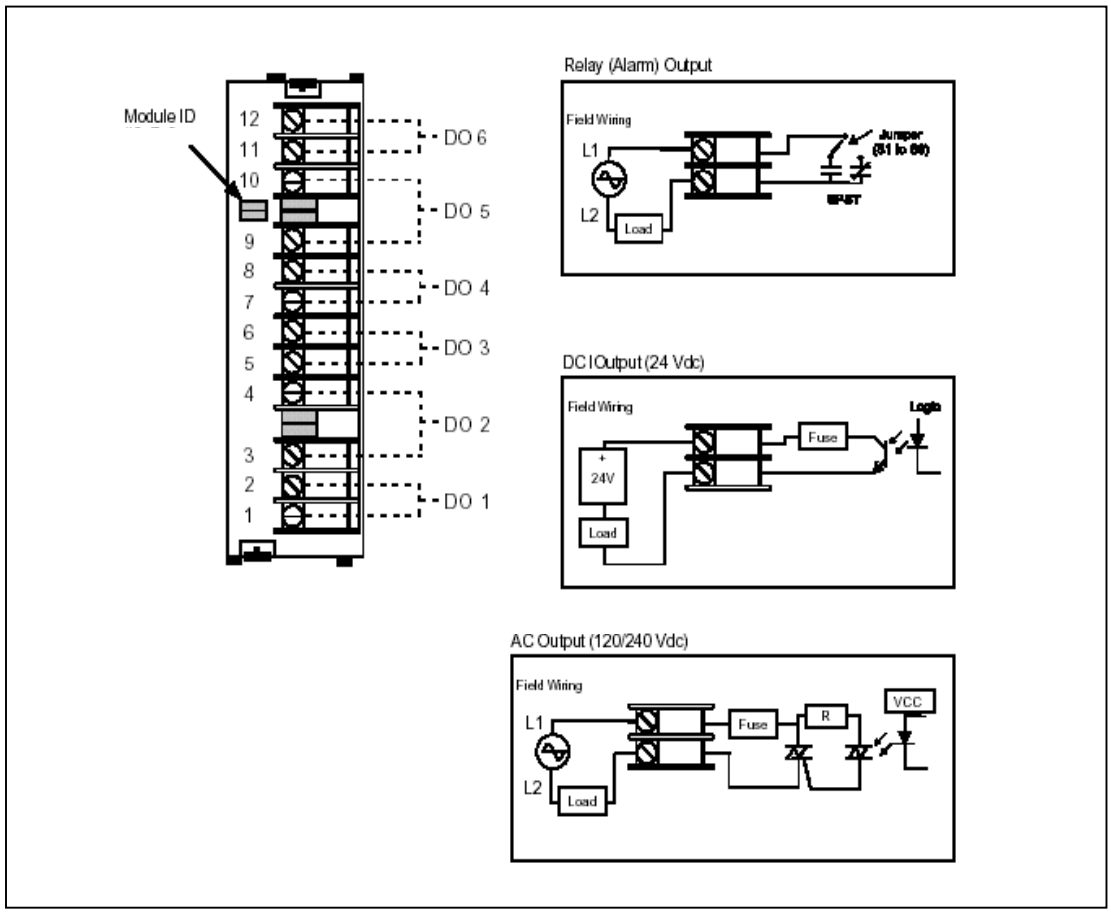


Figure 2-5 DO Board Terminal Block Connections

The Digital Output board with relay outputs contain jumpers to set the de-energized state of the relay contacts. The relays are factory set to Normally Closed (NC) for each output on the relay output board,

To change the state of the contacts: See Figure 2-6 DO Board Relay Contact Setting. Use a pair of needle-nose pliers and move the jumper from the location NC (normally closed) to the location NO (normally open).

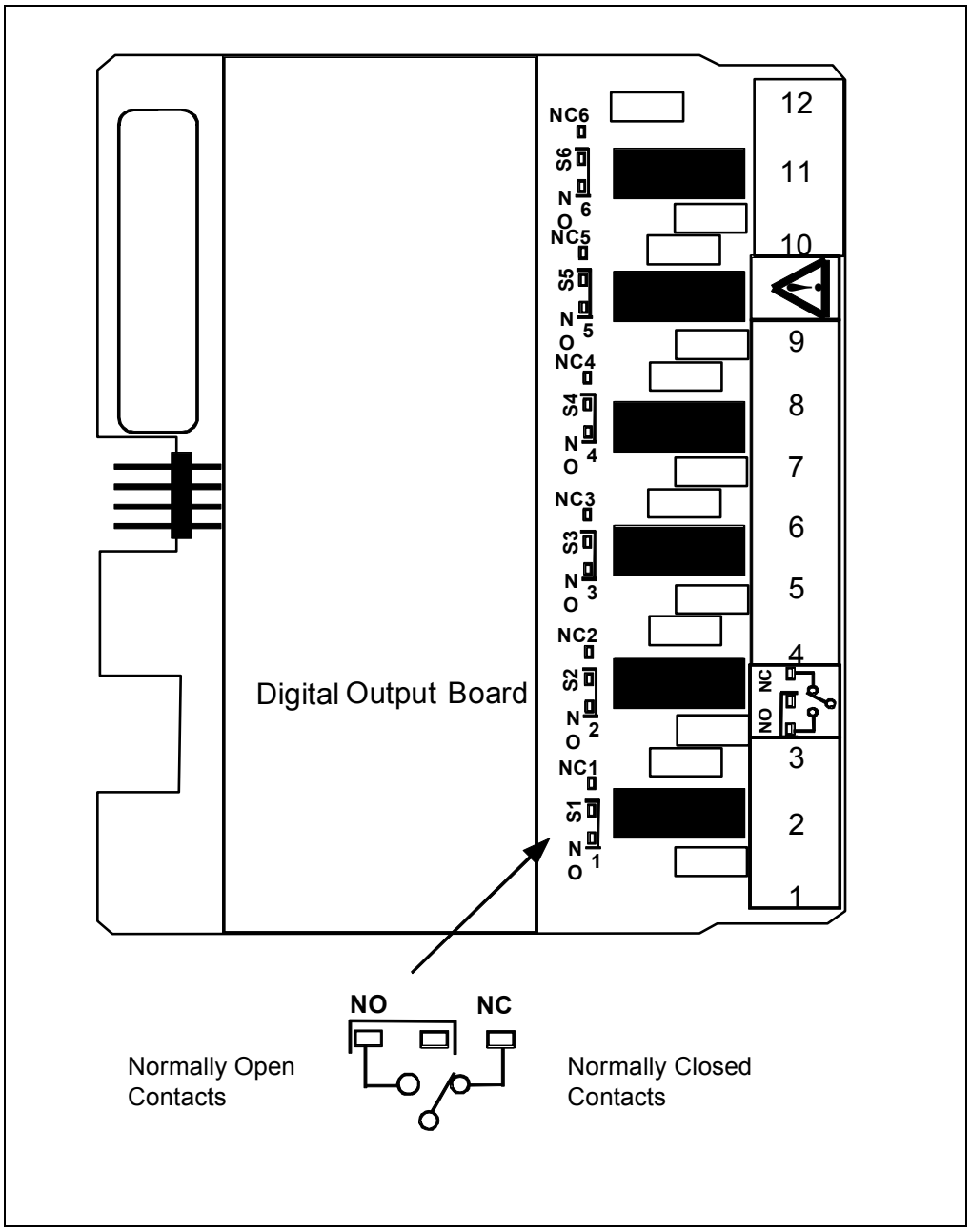


Figure 2-6 DO Board Relay Contact Setting

2.5.7 Wiring communications

This software package has been designed to operate with three kinds of serial communication standards which are: RS232, RS422 and RS485. Refer to the following chapters for the wiring configuration of each of them. For more details on the wiring, please refer to your computer product manual.

2.5.7.1 RS232 wiring configuration

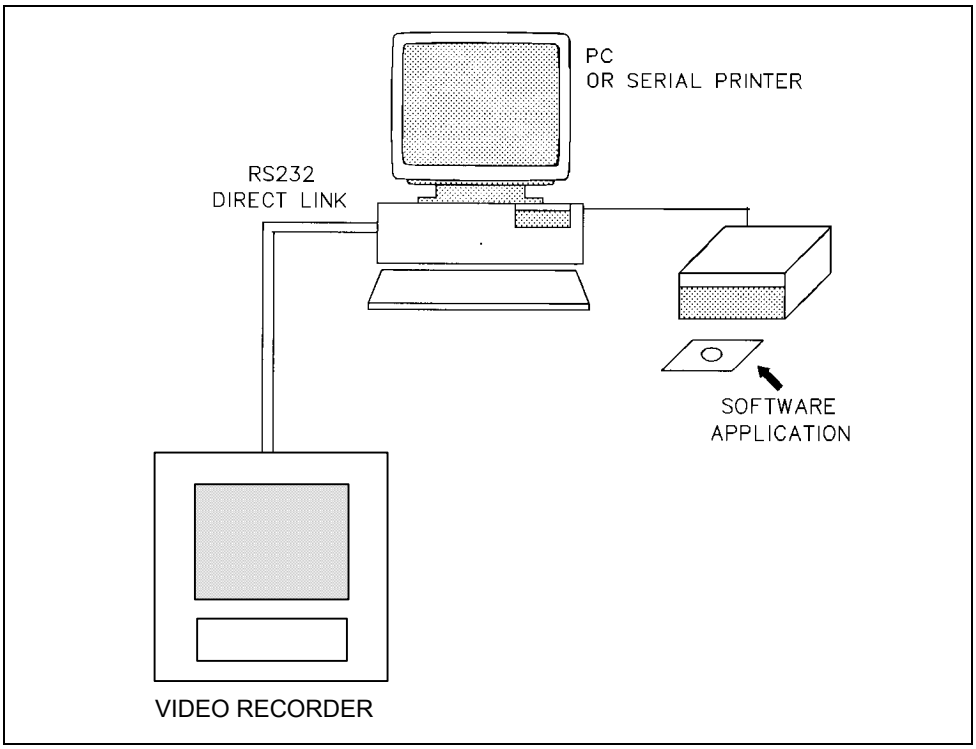
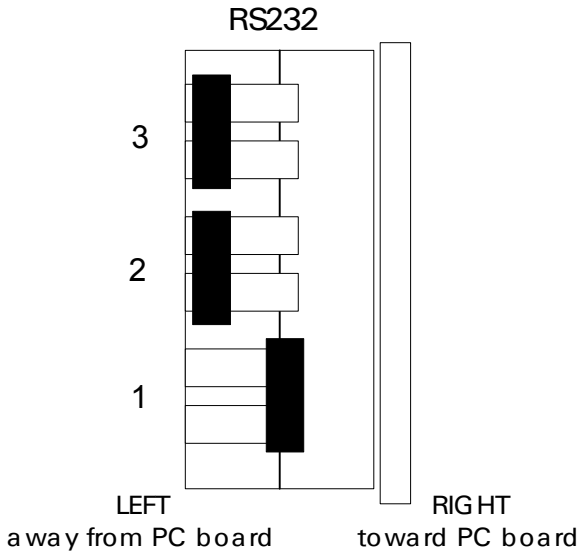


Figure 2-7 RS232 wiring configuration

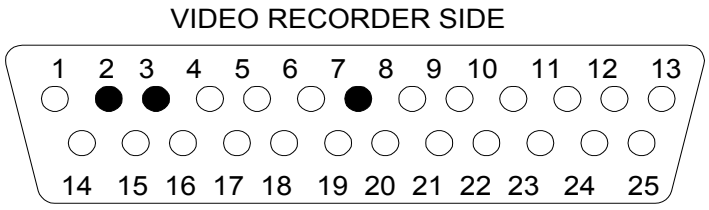
2.5.7.1.1 Switch configuration



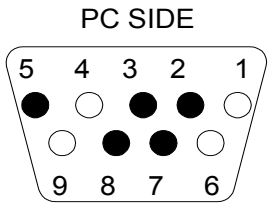
2.5.7.1.2 Interface connector

- *With DB9 connector*

Interface cable connectors pin arrangement and signal functions.



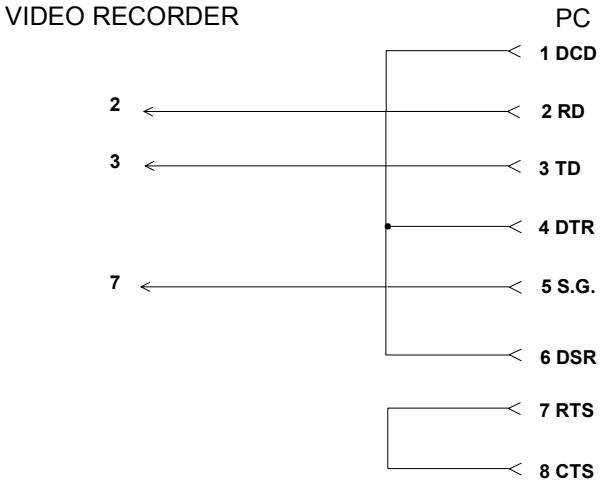
DB25 male connector face view



DB9 female connector face view

RECORDER	**PC**
Pin n°	Pin n°
2	2
3	3
5	4
7	5
20	6
20	8

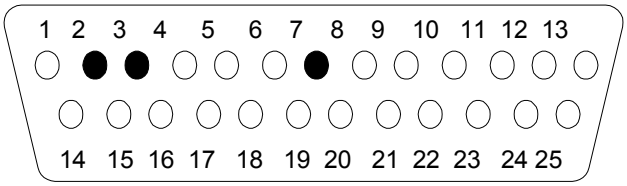
Note : Check compatibility with your PC as far as no standard for DB9 connector exists yet.



- *With DB25 connector*

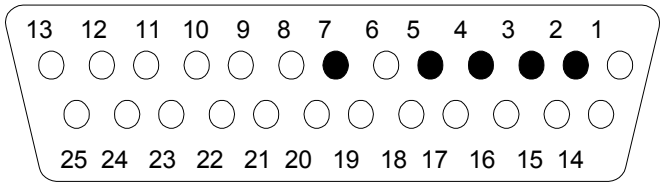
Interface cable connectors pin arrangement and signal functions.

VIDEO RECORDER SIDE



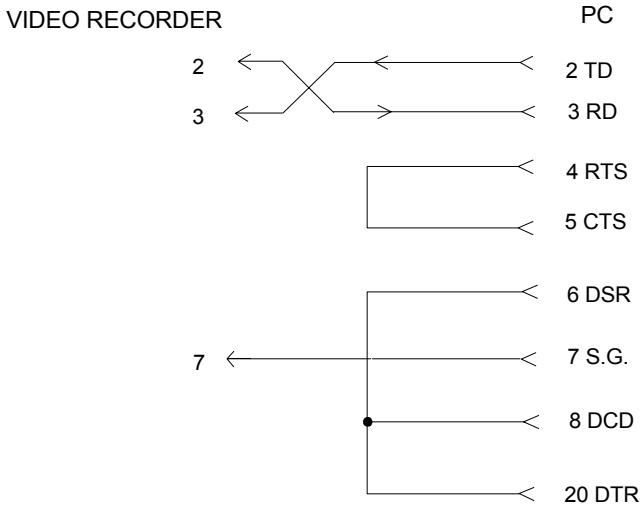
DB25 male connector face view

PC SIDE



DB25 female connector face view

VIDEO RECORDER	PC		
Pin n°	Pin n°	**Direction**	**Description**
3	2	to video recorder	transmitted DATA
2	3	from video recorder	received DATA
-	4	from DTE	request to send
-	5	to DTE	clear to send
7	7	-	ground



2.5.7.2 RS422 wiring configuration

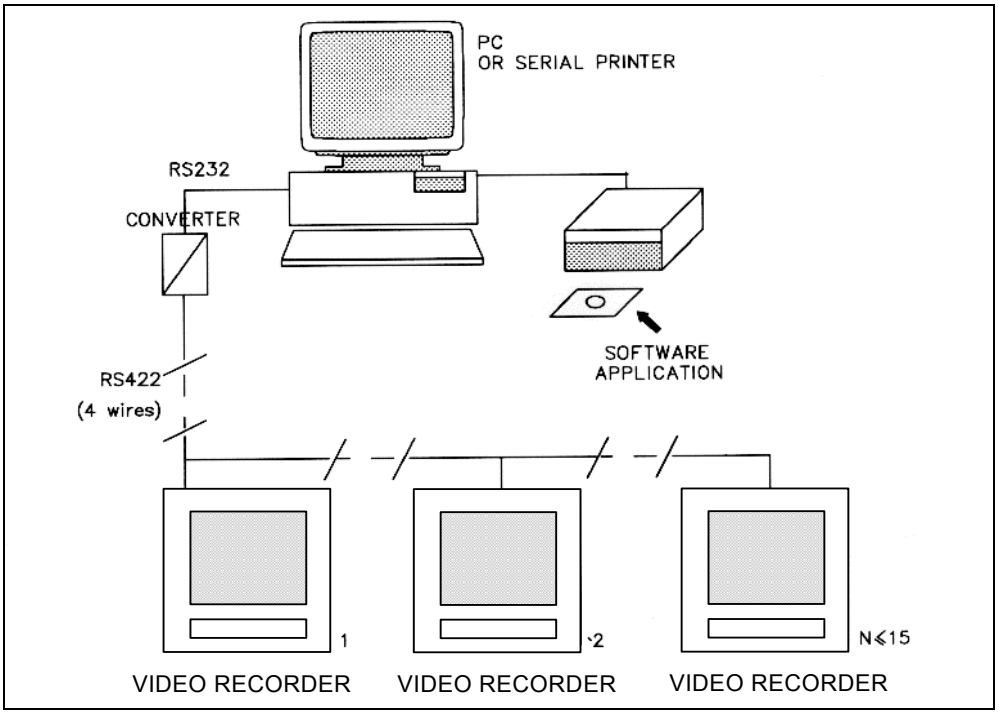
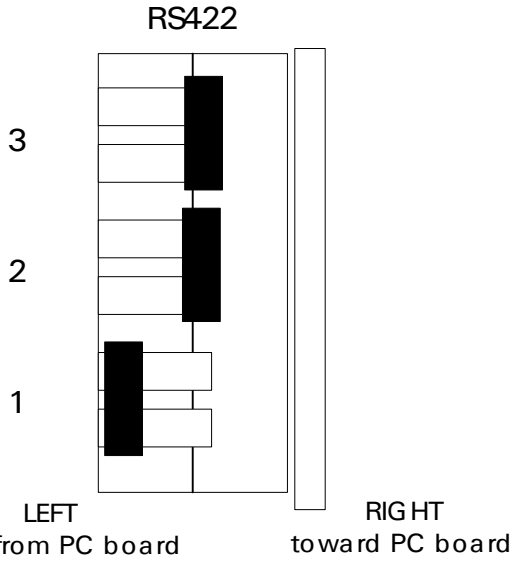


Figure 2-8 RS422 wiring configuration

2.5.7.2.1 Switch configuration



2.5.7.2.2 Interface connector

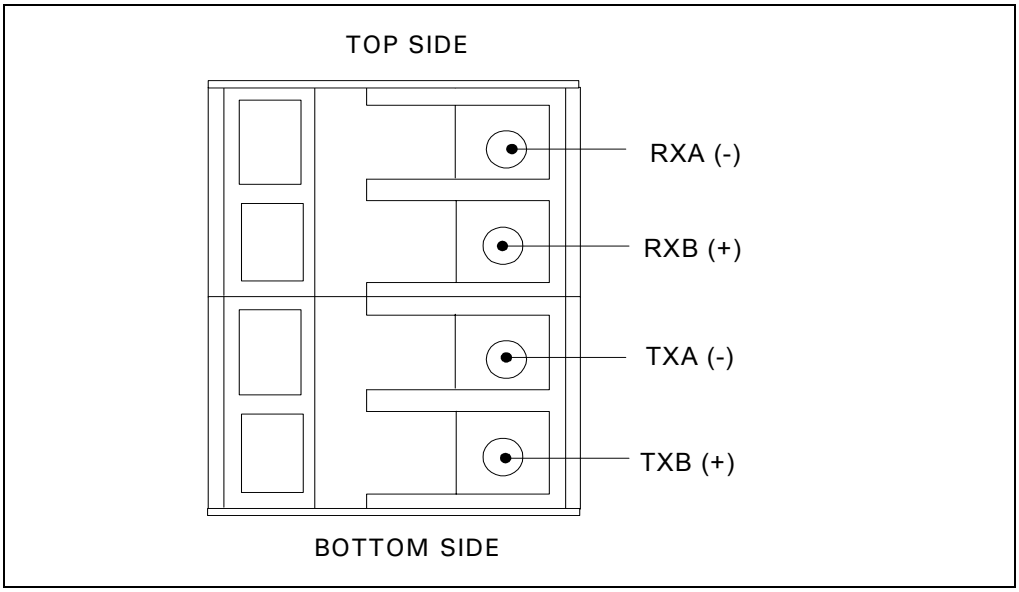


Figure 2-9 RS422 Inferface connections

2.5.7.3 RS485 (2 wires) wiring configuration

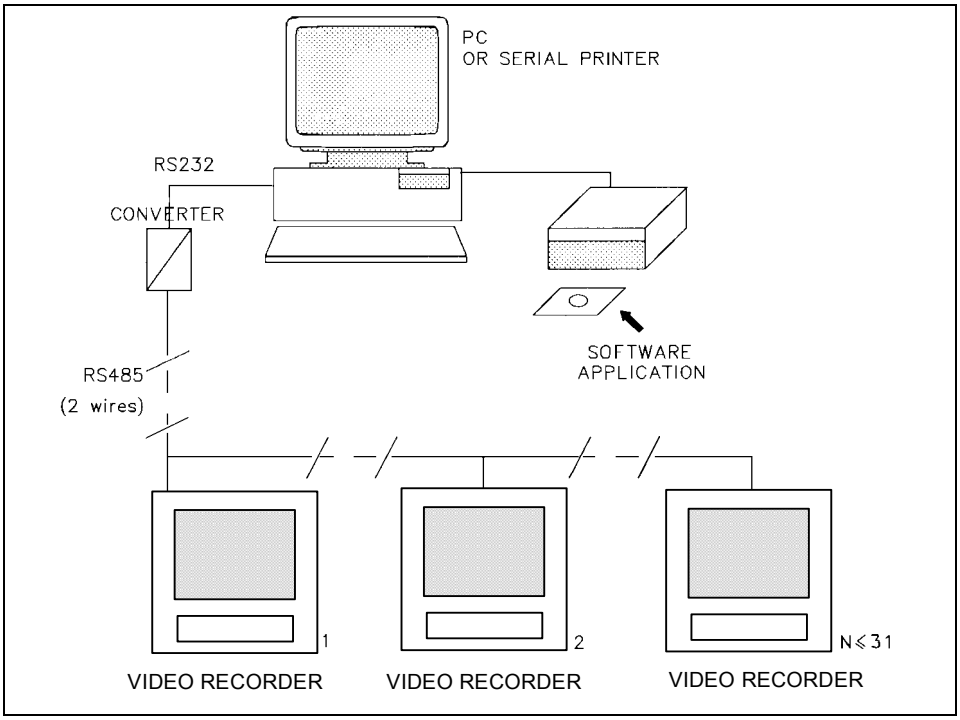
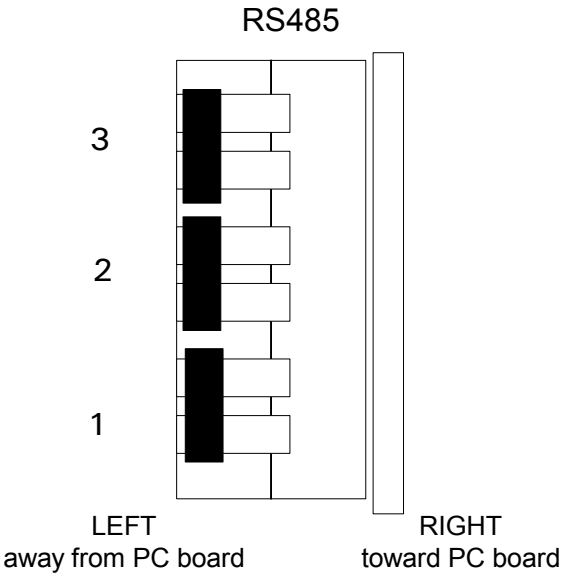


Figure 2-10 RS485 wiring configuration

2.5.7.3.1 Switch configuration



2.5.7.3.2 Interface connector

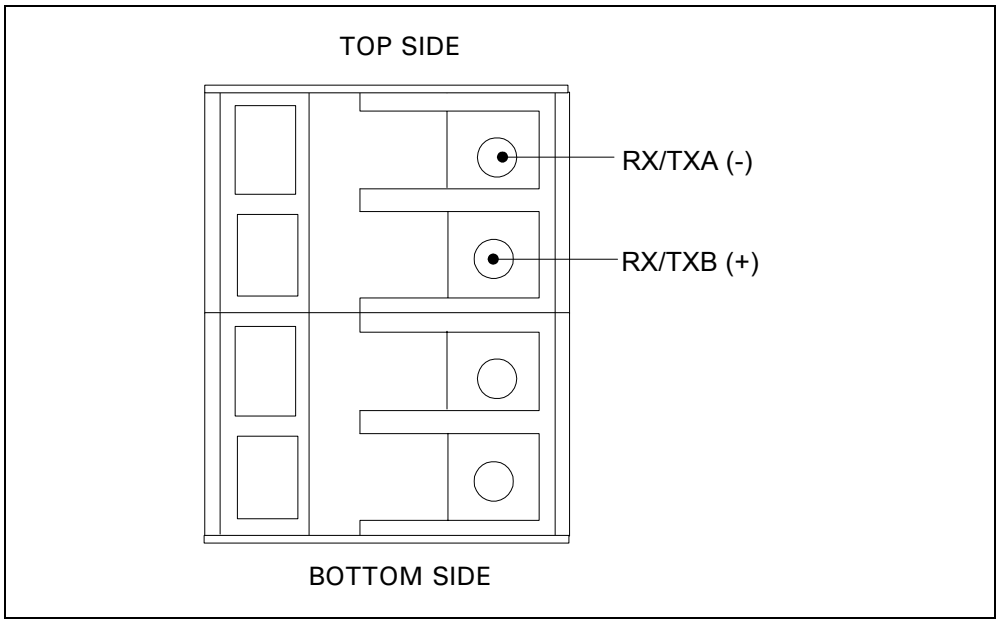


Figure 2-11 Interface connector

2.5.7.4 Connecting the RS422/485 link to a computer

The VRX180 video recorder with the RS422/485 Communications option can be connected your computer using one of two arrangements :

- Wired to an RS422/485 compatible serial port (if the computer is equipped with such a port).
- Wire the RS232 serial port of the computer to an RS232 to RS485 converter. The RS485 port of the converter should be wired to the Communications port of the VRX recorder.

Arrangement	Description
ICS plug-in I/O board	Wired directly to the RS422/485 port in your computer using an ICS plug-in I/O board which is specifically designed to interface with the IBM (or IBM compatible) PC, PC/XT; or PC/AT computer. This board is available from... ICS Computer Products, Inc. 5466 Complex Street Suite 208 San Diego, California 92123
Burr-Brown Converter	Using the RS232 port a Burr-Brown RS232 to RS422/485 converter installed between the RS232 port and the video recorder. This converter is available from : Burr-Brown International Airport Industrial Park P.O. Box 11400 Tucson, Arizona 85734 Part number LDM485ST, limited distance modem
Westermo converter	The Westermo MA44 converts RS232 to RS422/485. It is installed between the RS232 port and the video recorder.

2.5.7.5 Rear connection

The video recorder has built in circuits to reduce the effects of most electrical noise. We recommend that you review the following guidelines, to minimize the noise effects.

1. Separate the communication leadwires from the line voltage, the alarm output, contactors, motors etc...
2. For a communication distance, over 1.5 meters, use a separate metal tray, or metal conduit.
3. Use wiring cable composed of twisted pair wirings, with a shield for RS485 and RS422. Use a shielded cable for RS232.
4. Connect the shield wire to the ground, at one end only, preferably at the video recorder. Use for example a wiring cable type: Belden 9271 twinax, or equivalent.
5. We recommend to install a 120 ohms resistor between TXA and TXB, on the last video recorder on communication link.
6. The maximum capabilities are:

Type of communication	Distances max.	# of Unit
RS232	15 meters / 50 feet	1
RS422	1000 meters / 3280 feet	15
RS485	1200 meters / 4000 feet	31

3. Programming and Operating Concepts and Procedures

3.1 Overview

This section explains the instrument's programming and operating concepts and procedures. Read and understand this section before attempting to program and operate your instrument.

3.2 Quick Start Programming

Use this section to quickly start up your instrument. This section contains the basic concepts you should know for configuring the instrument. For more details on specific topics, you should refer to section 4 and 5 of this manual.

Step	Action	See
1	To program analog inputs	Section 4.7 Program Analog Inputs
2	To program control (if your application has control)	Section 3.14 How to program common configurations Section 4.8 Program Control Loops Section 5 Setpoint Profiler (if your instrument has a setpoint profiler) Section 4.9 Program Analog Outputs
3	To configure displays	Section 4.18 Program Displays
4	To configure data storage	Section 4.26 Data Storage
5	To program other functions	Remaining sections in Section 4 How To Program Function Blocks and Features

3.3 Modes of Operation

The instrument has three modes of operation: Program, Online, and Maintenance. Each mode has its own menus. Most menu items provide access to sub-level menus. The SET MODE item switches the instrument from one mode to another. Your instrument may have reduced menus if options are not present.

Program mode

Program Mode is an off-line mode for programming (configuring) the instrument. In this mode, all inputs and outputs are frozen. If any of the five relays are assigned as DAT outputs the recorder will stop pulsing them when it is placed into Program Mode. The outputs will remain frozen in their present state, either On or Off.

Online Mode

Online Mode enables full use of the instrument with its inputs, outputs and internal programming. In this mode, it is fully interactive with all externally connected elements.

Maintenance Mode

Maintenance Mode is an off-line mode for maintaining proper and complete functioning of the instrument. Functions include calibration, off-line diagnostic testing, and various setups for operation. In Maintenance Mode, all inputs and outputs are frozen. If any of the five relays are assigned as DAT outputs the recorder will stop pulsing them when it is placed into Maintenance Mode. The outputs will remain frozen in their present state, either On or Off.

3.4 Menu Navigation

Moving between the Program, Online, and Maintenance modes of the instrument is accomplished through use of the instrument's Menu, Up Arrow, Down Arrow, and Enter keys located on its front door. Refer to Figure 3-1.

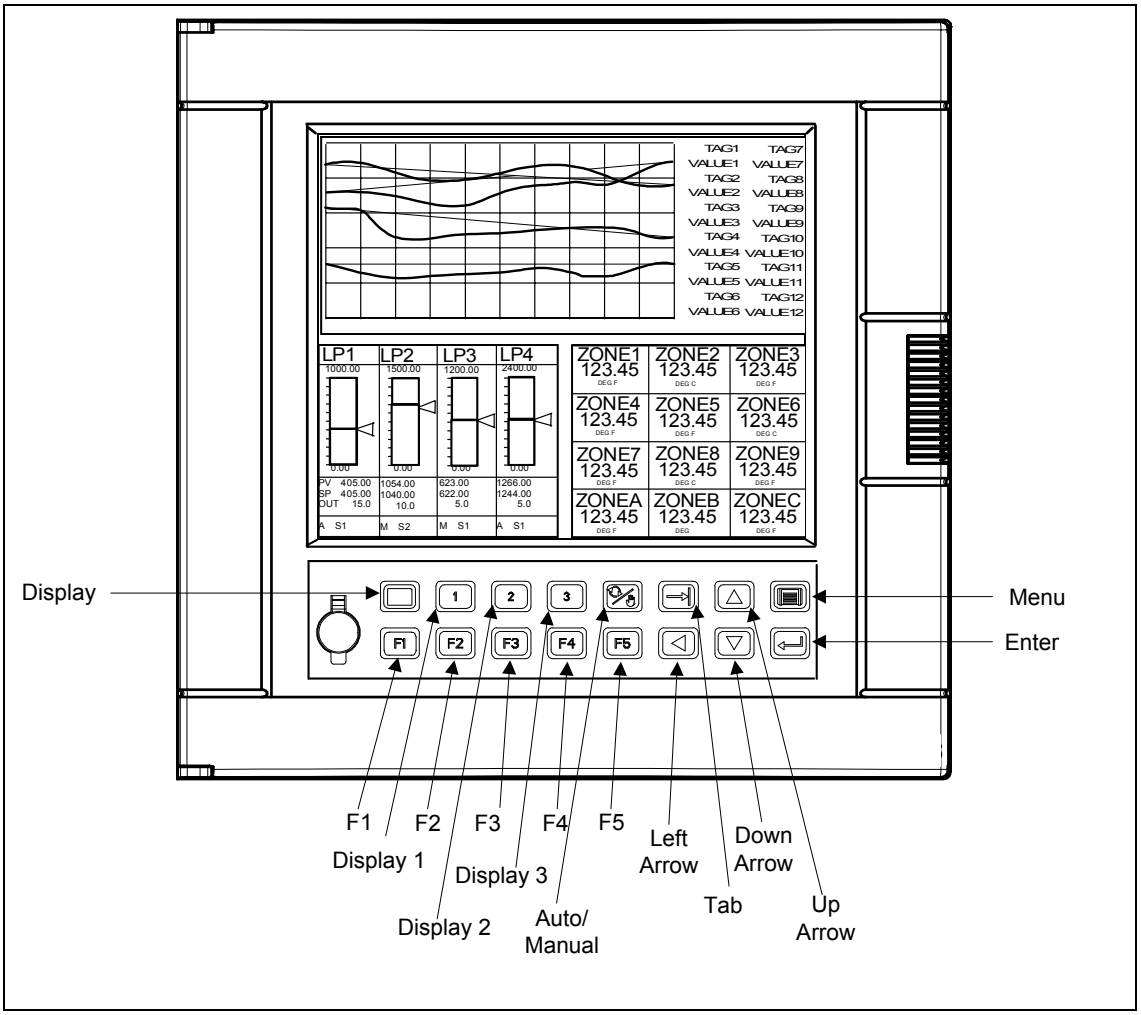


Figure 3-1 Video Recorder Front Door Buttons

A more detailed explanation of the function of each button appears in Section 3.5.

To develop a feel for navigating between modes, power up the instrument and perform the sequence of steps that follows.

Upon powering up the instrument for the very first time, the logo display will initially appear. Press the Menu button several times until the ON LINE, PROGRAM, or MAINTENANCE mode MAIN MENU is displayed. Refer to Figure 3-2. Note: Menus are shown with all possible options; your menu may not have all options.

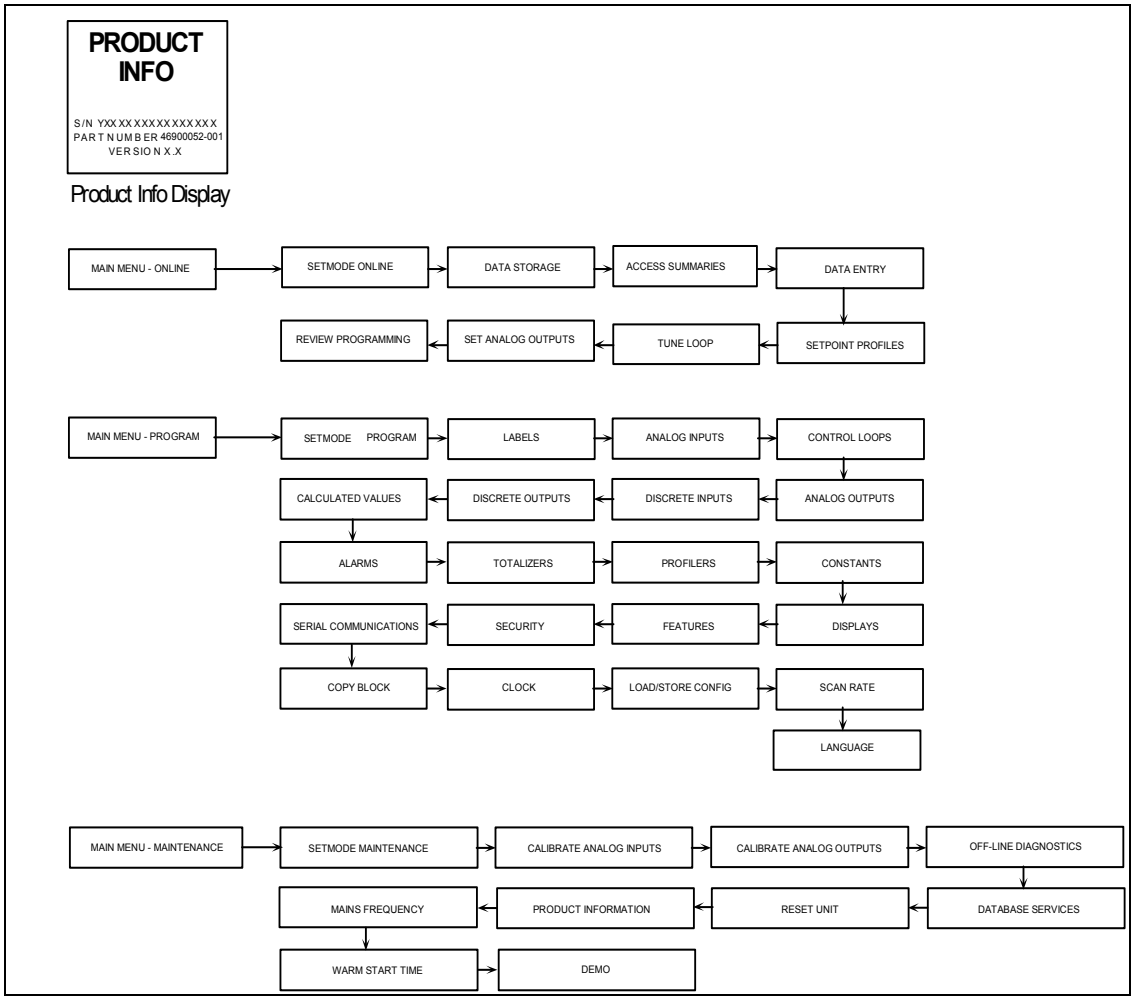


Figure 3-2 Menu Navigation Guide Through ON LINE, PROGRAM, and MAINTENANCE mode MAIN MENUs.

Once you have established which MAIN MENU you are on, use the Up Arrow and Down Arrow buttons to verify each MAIN MENU choice as indicated in Figure 3-2.

Use the Up Arrow and Down Arrow buttons to find and highlight the menu's SET MODE prompt.

When the SET MODE prompt is highlighted, press the Enter button.

Use the Up Arrow or Down Arrow buttons to switch the instrument to one of the other two instrument modes and press the Enter button.

Once within the mode selected in Step 5, scroll through the mode's MAIN MENU using the Up Arrow and Down Arrow buttons. Verify each menu choice as indicated in Figure 3-2.

Repeat Steps 3 through 6 for the last of the three mode selections possible.

Having completed the preceding exercise, changing the instrument's mode should now be a simple task. Furthermore, a fundamental understanding of how the Menu, Up Arrow, Down Arrow, and Enter buttons work should now be at your fingertips.

Now use the Menu, Up Arrow, Down Arrow, and Enter buttons to verify the ON LINE, PROGRAM, and MAINTENANCE mode sub-level menus detailed in Figure 3-3, Figure 3-4 and Figure 3-5. The sub-level menus shown represent only the first sub-level below each mode's MAIN MENU. There are several sub-level menus, not indicated here, that run further below each first sub-level. Note that once inside of a sub-level menu, regardless of how "deep" the level is, a press of the Menu button will return you to the next highest menu level. In case you get lost within a mode's sub-level menu, keep pressing the Menu button until the ON LINE, PROGRAM, or MAINTENANCE mode MAIN MENU appears on screen.

Be advised that Figure 3-2 through Figure 3-5 comprise a basic "road map" for navigating the menus within the programmer's three modes. Sections 4 through 8 of this manual will provide detailed descriptions of each menu choice and complete guides through all the sub-level menus that run below the levels indicated in these Figures.

ATTENTION

The following menus contain all possible options. Your instrument may not include some items shown here.

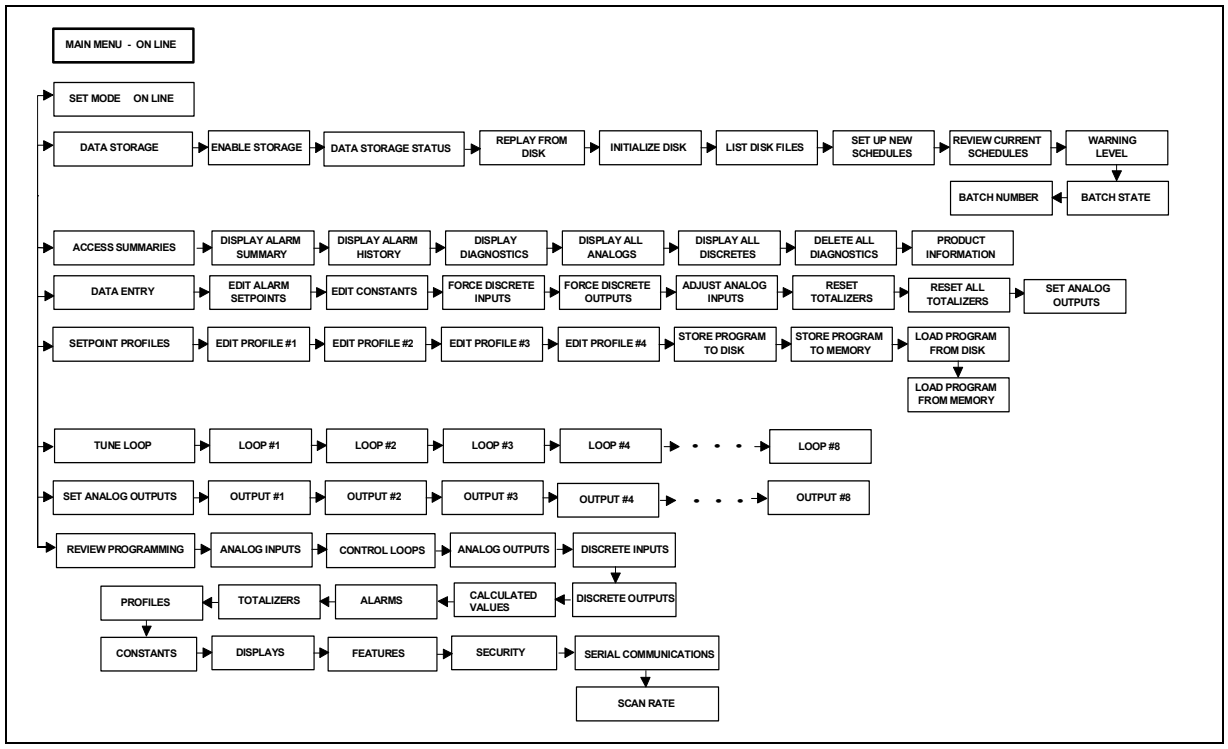


Figure 3-3 ON LINE mode MAIN MENU

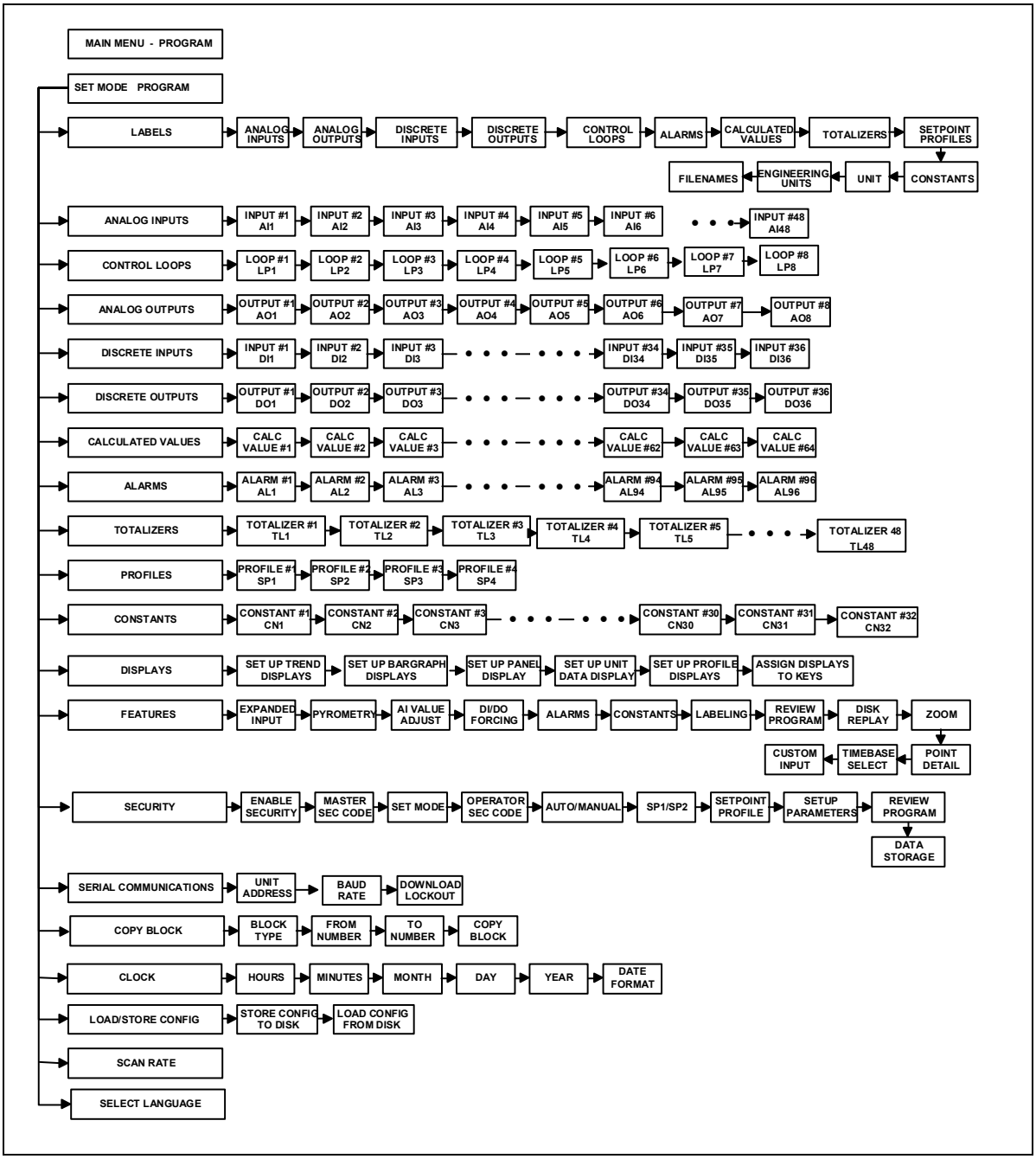


Figure 3-4 PROGRAM mode MAIN MENU

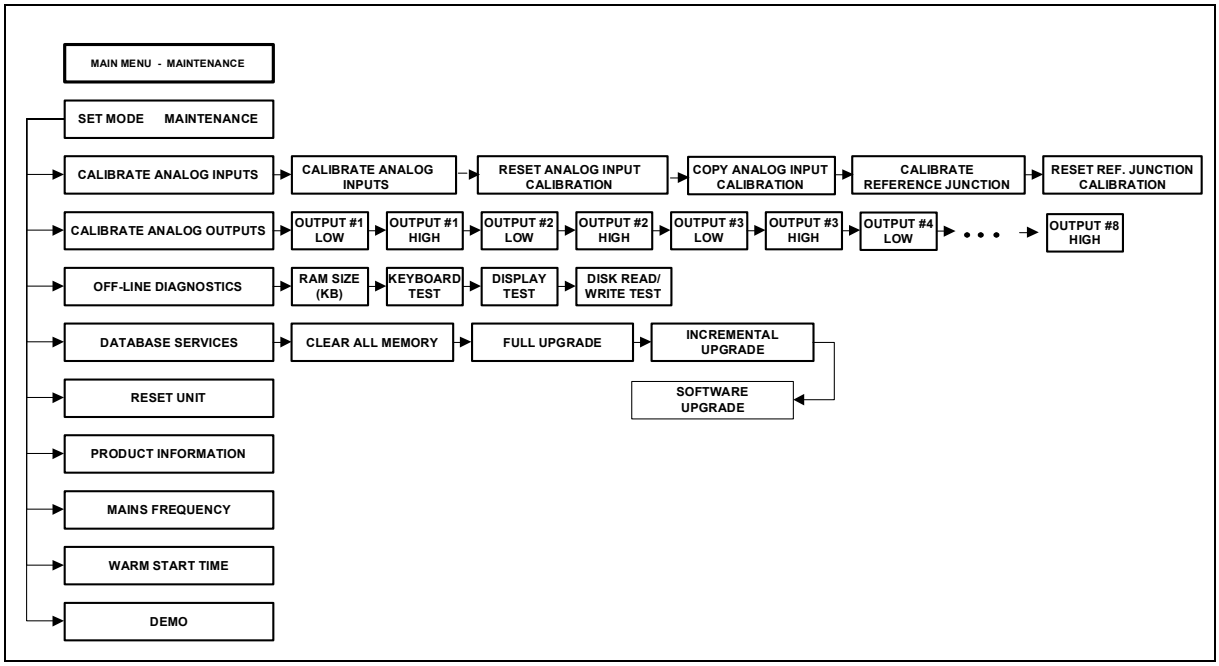


Figure 3-5 MAINTENANCE mode MAIN MENU

3.5 Button functions

In all modes, the instrument is operated by using the front panel buttons to view and select items from menus and displays. Table 3-1 describes each panel button and its functions.

Table 3-1 Button Functions

Symbol	Name	Function	Operating mode in which function applies		
			Progra	Online	Maint
	Menu	• Accesses Online Mode Menu from online primary display.		✓	
		• Backs cursor out of a menu to next higher menu level. Use when finished looking at or changing menu items.	✓	✓	✓
		• If changes were made and you are prompted to PRESS ENTER TO SAVE, press to exit menu without saving changes.	✓	✓	✓
	Up Arrow/ Previous	• Moves cursor up a menu or list of choices.	✓	✓	✓
		• Immediately after selecting a menu item to change, repeatedly scrolls through NONE or OFF, PARM(parameters), 0-9 (of most significant digit of a number), minus sign (-). Once you move the cursor off a number's most significant digit, then only 0-9 are choices. You can change a number to a parameter, NONE, or OFF only while the cursor is initially on the most significant digit.	✓		✓
		• When selecting most significant digit of a number, scrolls through 0-9, minus sign, and OFF or NONE (if available). For other digits, scrolls through 0-9.		✓	
		• When entering a label such as a DESCRIPTOR or TAG, scrolls through A-Z, 0-9, period (.), hyphen (-), slash (/), plus (+), asterisk (*), blank ( ).	✓		
		• In loop display, increases loop's setpoint value (loop must be in Auto mode).		✓	
		• In loop display, increases loop's output (loop must be in Manual mode).		✓	
		• Scrolls a trend forward in time.		✓	

Table 3-1 Button functions (continued)

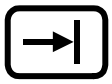
Symbol	Name	Function	Operating mode in which function applies		
			Program	Online	Maint
	Down Arrow/ Next	• Moves cursor down a list/menu.	✓	✓	✓
		• When selecting a number, letter, or decimal point position, moves cursor one character to the right, then wraps around to leftmost character.	✓	✓	✓
		• In loop display, decreases loop's setpoint value.		✓	
		• In loop display, decreases loop's output (loop must be in Manual mode).		✓	
		• Scrolls a trend backward in time.		✓	
	Left Arrow	• Numeric entry: moves one digit to left. • Text entry: moves one character to right.	✓	✓	✓
	Enter	• Selects displayed menu item and either displays its submenu or moves cursor to the right for data entry.	✓	✓	✓
		• Enters a changed value or parameter.	✓	✓	✓
		• If prompted to SAVE CHANGES?, saves changes made and returns to higher menu.	✓	✓	
	Tab	• When trend or panel display is on, accesses Trend menu or panel display menu to adjust the appearance of the display.		✓	
		• When either above menu is shown, advances display to next live point.		✓	
		• When Setpoint Profile Trend display is shown, accesses a menu for viewing and controlling operation of the profile.		✓	
		• On Loop displays, tabs cursor to next loop data field for adjustment.		✓	
	Display	From any display or menu, pressing this button changes the instrument to online mode* and accesses the display programmed as Display #4. Repeated presses accesses displays #5 through #10, then wraps around to display #4 again. See Table 4-64 on page 154 for more information on the Displays.	✓	✓	✓

Table 3-1 Button functions (continued)

Symbol	Name	Function	Operating mode in which function applies		
			Program	Online	Maint
	Display 1	From any display or menu, pressing this button changes the instrument to online mode* and accesses the display programmed as Display #1. See Table 4-64 on page 154 for more information on Displays.	✓	✓	✓
	Display 2	From any display or menu, pressing this button changes the instrument to online mode* and accesses the display programmed as Display #2. See Table 4-64 on page 154 for more information on Displays.	✓	✓	✓
	Display 3	From any display or menu, pressing this button changes the instrument to online mode* and accesses the display programmed as Display #3. See Table 4-64 on page 154 for more information on Displays.	✓	✓	✓

* Note: Changing to ONLINE mode by pressing any of the Display buttons can cause incorrect values to be displayed. The values will correct themselves in a few seconds. To avoid this potential annoyance, first change to online mode by selecting SET MODE from the PROGRAM or MAINTENANCE menus, then press a Display button to access the displays.

Table 3-1 Button functions (continued)

Symbol	Name	Function	Operating mode in which function applies		
			Progra	Online	Maint
	Auto/ Manual	• In a loop display, toggles loop between Auto and Manual modes (loop's Force Remote Manual discrete must be OFF). • In a loop display, toggles loop between Remote Manual and Manual modes (loop's Remote Manual discrete must be ON). • Does not function if loop's Discrete vs. Key discrete is ON. In this case, the button's functioning has been transferred to the loop's Auto/Manual Select discrete.		✓ ✓ ✓	
ATTENTION The following keys are like Digital Inputs on the keypad of the instrument. They must be configured as part of the instrument's function blocks in order to be active.					
F1	F1 START	• When pressed, this key raises the SY1 F1 signal for 1 machine scan cycle. • For instruments with the Setpoint Profiler, user typically programs it to Profiler Start input or Totalizer Reset.		✓	
F2	F2 HOLD	• When pressed, this key raises the SY1 F2 signal for 1 machine scan cycle. • User typically programs it to Profiler Hold input (Use Edge/Level input selection) or to Totalizer Reset.		✓	
F3	F3 RESET	• When pressed, this key raises the SY1 F3 signal for 1 machine scan cycle. • User typically programs it to Profiler Reset input or Totalizer Reset.		✓	
F4	F4	• When pressed, this key raises the SY1 F4 signal for 1 machine cycle.		✓	
F5	F5	• When pressed, this key raises the SY1 F5 signal for 1 machine cycle.		✓	

3.6 Text Entry From External Sources

QWERTY keyboard

To use a keyboard to enter text such as labels, numbers, and equations, connect an AT Qwerty keyboard to the mini DIN connector. See Table 3-2 for key functions.

The instrument's cursor must be on the text to be changed (on the right side of the display) before you type in the new text. Press Enter to accept the changes or press Menu to reject the changes.

Table 3-2 QWERTY Key Equivalents

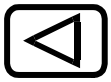
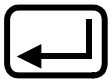
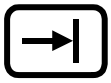
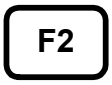
Button	QWERTY key	Function
	ESC	• Exits prompt or menu without saving changes. • Changes from online display to online menu.
	↑	• Scrolls up a menu or list
	↓	• Scrolls down a menu or list
	←	• Increments the value of the selected field.
	Enter ↵	• Selects menu item to change it. • Saves changes made.
	F4	• Changes to online mode and shows online displays. • Exits Point/Details menu.
	F3	Accesses Display #1.
	F10	Accesses Display #2
	F11	Accesses Display #3
	F2	• Toggles Loop between Automatic and Manual. • This button can also be used as Display 4 when the instrument does not have control.

Table 3-2 QWERTY Key Equivalents (continued)

Button	QWERTY key	Function
	F1	• Moves cursor around displays. • Accesses Point/Details menu.
	F5	Initiates a discrete action programmed to this key, such as Starting a Setpoint Profile or resetting a totalizer.
	F6	Initiates a discrete action programmed to this key, such as Holding a Setpoint Profile or resetting a totalizer.
	F7	Initiates a discrete action programmed to this key, such as Resetting a Setpoint Profile or resetting a totalizer.
	F8	Initiates a discrete action programmed to this key.
	F9	Initiates a discrete action programmed to this key.

ASCII barcode reader

To enter text such as labels, numbers, and equations with a barcode reader, connect the barcode reader to the mini DIN connector with an adapter (part No. 104286). The instrument buttons remain functional. See section 3.7 on how to connect a mini DIN connector.

To enter labels, the instrument's cursor must be on the text to be changed (on the right side of the display) before you scan in the new text from the barcode. Press Enter to accept the changes, or press Menu to reject the changes.

The barcode reader may also be used on the instrument trend screens to enter text data that will be stored as a time stamped event. The ASCII data is split up into three fields:

Description	16 characters
Tag	7 characters
State	6 characters

The first 16 characters will go into the description field. The next 7 into the tag field and so on.

This data will be time stamped and stored in the event file (.LNE) on the floppy disk.

Barcode Reader Recommendation

The barcode reader should output ASCII keyboard data.

The reader should be capable of Code 39 barcode input.

The connector should be able to connect to the Keyboard connector located under the door.

3.7 Connecting a keyboard or a barcode reader

The mini DIN connector is located on the front door of the instrument.

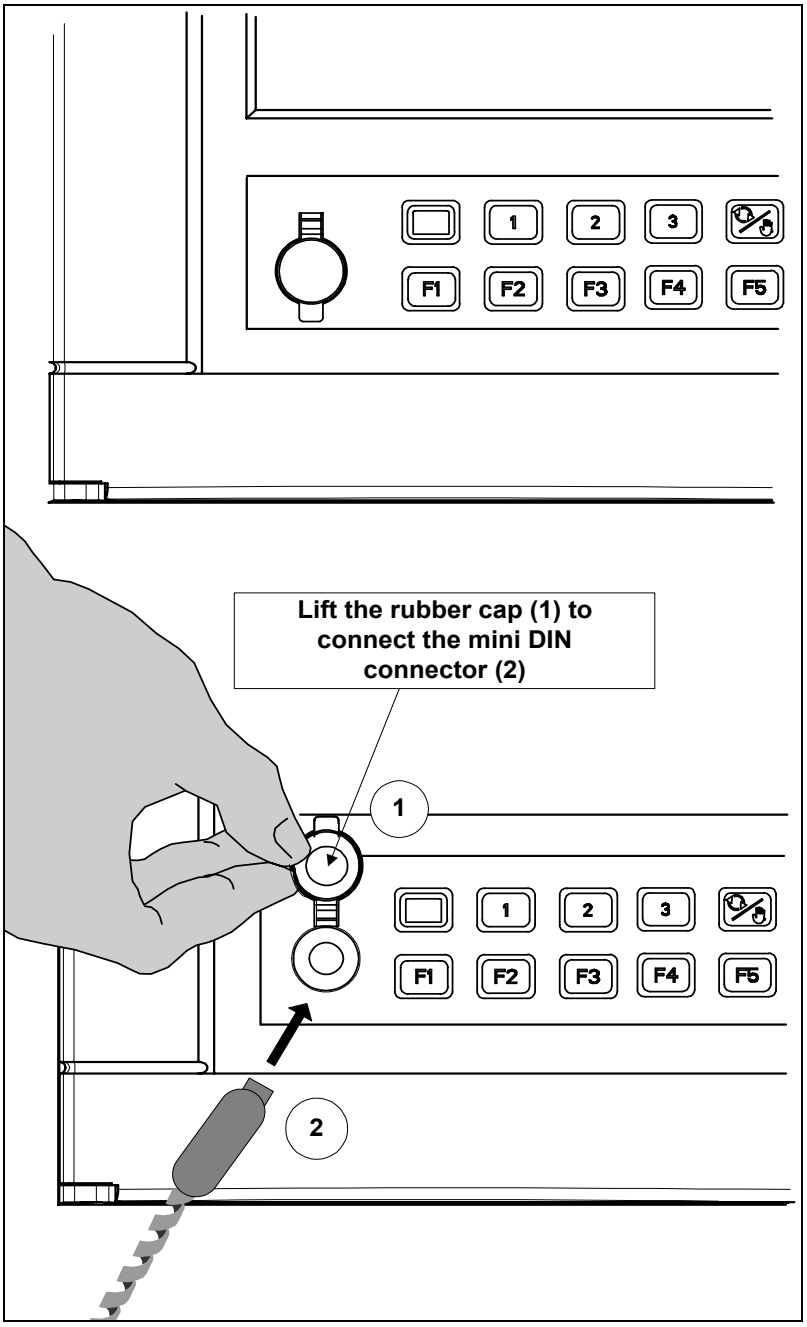


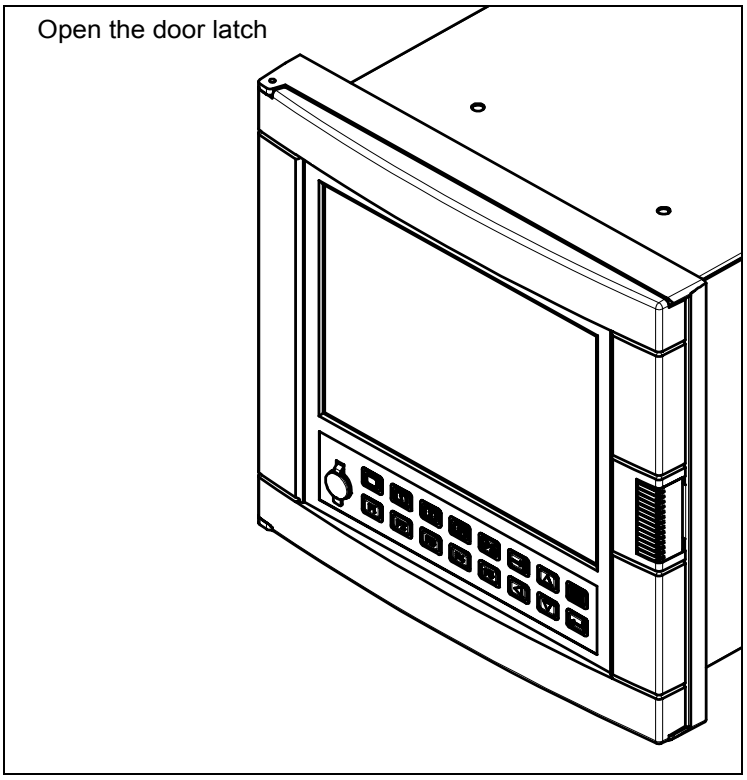
Figure 3-6 Connection of a keyboard or a barcode reader

3.8 Installing and removing a floppy disk

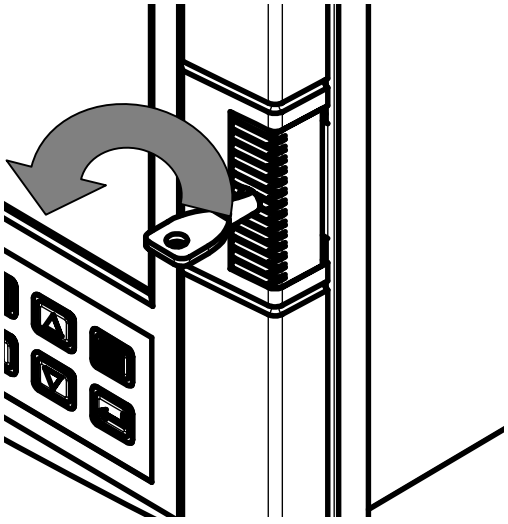
To install or remove a floppy disk from the instrument, open the door as described in the following drawings.

NOTE: recording on the disk stops when door is open.

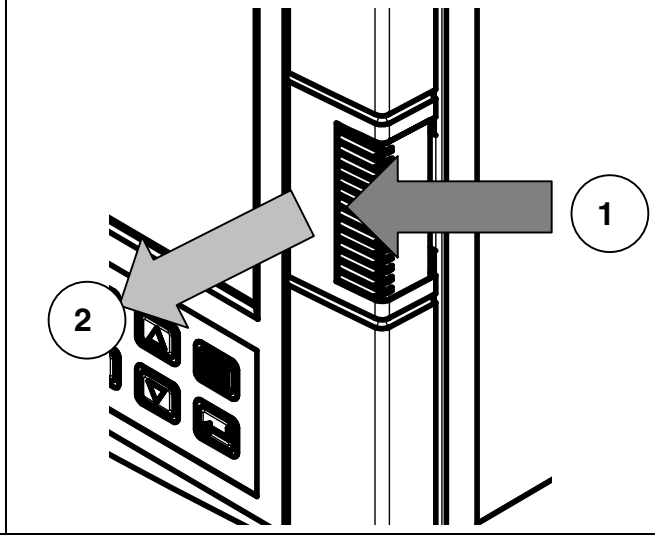
Open the door latch



Door with key lock



Door with latch



3.9 Definition of Function Blocks

Definition

A *function block* is a unit of software that performs a set of operations on its *input parameters* and *function block parameters* and produces *output parameters*. These output parameters can be programmed as inputs to other function blocks, whose output parameters can be programmed as inputs to other function blocks, and so on. By programming all desired function blocks' input parameters and function block parameters, you configure the instrument to measure and control your process.

Types of function blocks

Each function block performs a set of operations which fulfills a unique purpose. For example, the Analog Input function blocks processes the analog input data, the alarm function block processes alarms, and so on.

Table 3-3 describes each function block.

Some function blocks—namely, Analog Input, Analog Output, Discrete Input, and Discrete Output—interface with the hardware; that is, they are the link between the instrument and the input or output hardware. The Analog Input and Discrete Input function blocks convert the incoming process data (like the process variable or any discrete on/off signals from a switch) into information usable by the instrument. This incoming information is processed according to the entire function block configuration in the instrument, and it is ultimately passed on to the output function blocks. The Analog Output and Discrete Output function blocks convert this output information into a voltage or current which is fed to the corresponding output hardware (like a current output or relay).

Other function blocks are not directly “seen” by the hardware; they are purely software. They can be thought of as the middle of the process described in the previous paragraph. For example, a Standard Splitter Calculated Value can split a control loop’s output into 2 values: one for heating and one for cooling. These 2 values can be passed on to the Analog Output function block which ultimately controls the amount of output current or voltage.

Flow of information

The “flow” of information— from the input hardware to the input function blocks to the function block configuration to the output function blocks to the output hardware—can be likened to a river flowing from upstream to downstream. In some cases, like with a control loop’s feedback, this analogy is not true because the information is flowing in a circle, but it is a helpful way to view how function blocks are generally interconnected. For example, the Analog Input function block is typically upstream of the Control Loop function, which is typically upstream of the Analog Output function block. Of course, if two function blocks are not directly or indirectly connected, there is no flow between the two. Just remember that every function block has input, does a set of operations, and produces an output. When several function blocks are linked together, there is a flow of information.

Table 3-3 Function Block Types

Function block name	Type	Maximum available*	Purpose
Alarm	AL	96	Causes alarms under specified conditions.
Analog Input	AI	48	Interfaces with measuring input hardware (thermocouple, RTD, mA, volts).
Analog Output	AO	8	Interfaces with analog output hardware (current output (CAT)) or with output relay hardware (time proportion (DAT)).
Calculated Value	CV	96	Performs various calculations on specified parameters.
Constant	CN	32	Outputs a number or an analog parameter value.
Discrete Input	DI	36	Interfaces with discrete input hardware (dry contact closure).
Discrete Output	DO	36	Interfaces with output relay hardware (AC relay, DC relay, mechanical relay, open collector output).
Loop	LP	8	PID or ON/OFF control with various outputs.
Setpoint Profiler	SP	4	Generates a time-varying setpoint for a loop's **Setpoint #2**.
System	SY	1	Outputs discrete status of alarms, data storage, and diagnostics; outputs analog value of reference junction temperature. This function block is not programmable; its outputs are produced automatically.
Totalizer	TL	48	Outputs accumulated total over time.
* Depends on options ordered.			

Why use function blocks?

Function blocks give you configuration flexibility. For instance, the instrument does not have a dedicated relay that is activated during an alarm; instead, you can program any of several Alarm function blocks to control any relay. Also, there is not a specific input for your process variable; any of several Analog Input function blocks can be programmed to be your process variable. In general, function blocks let you connect the output parameter of any function block to the input parameter of any function block.

3.10 Components of function blocks

The three components of a function block are:

Input parameter(s)

Function block parameter(s)

Output parameter(s).

Figure 3-7 shows the function block Alarm #1's components.

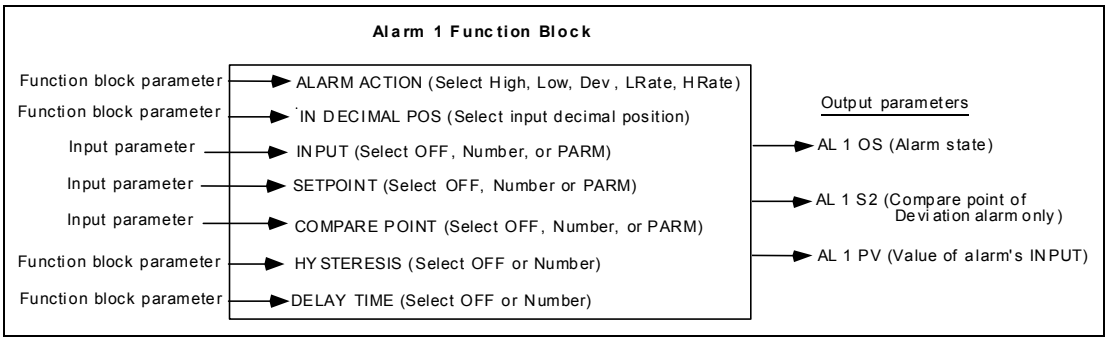


Figure 3-7 Alarm 1 Function Block Components

Input parameter

A function block's input parameter can be configured to be OFF, a number, or it can receive its data from outside the block from another block's output codes. These output codes are shown in Table 3-4. That is, an input parameter is any menu item that can be programmed as (connected to) one of these output codes. These output codes are grouped under the menu choice PARM. When you are programming a function block and one of your choices is PARM, you know you are programming an input parameter. See Figure 3-7.

For example, suppose you are programming an alarm function block. One of the alarm's menu items is INPUT, which specifies which point will be monitored for an alarm condition. One of the choices for the INPUT is PARM, which lets you connect the INPUT to one of the output codes in Table 3-4. Therefore, the INPUT is an input parameter because it receives its data from another function block.

Some function blocks can have multiple input parameters. For example, an Alarm function block has an INPUT and a SETPOINT, both of which can be connected to other function blocks.

Discrete Input function blocks have no input parameters; that is, they have no inputs that can be connected to another block's output codes.

Function block parameter

A function block parameter's data is contained within the block. When you are programming a function block and are not given a choice of PARM, you are programming a function block parameter. Typical choices when programming a function block parameter are NONE, OFF, any numerical value, or a list of options for the parameter, but not PARM. See Figure 3-7.

For example, to program an Alarm function block's ALARM ACTION, you select from a list of choices: NONE, LOW, HIGH, DEV, LRATE, HRATE.

Other function block parameters are an Analog Input's RANGE LOW and RANGE HIGH, where you specify the voltage range or temperature range.

Output code

An output code is the result of the function block's operations on the input parameters and function block parameters. It is designated by one of the two-character output codes shown in Table 3-4. An output code can be programmed to be the input to one or several other function blocks. See Figure 3-7.

Output codes are either discrete (can be on or off) or analog (numerical value). For example, DI1 OS is the output status of Discrete Input #1: on or off. AI1 OV is the output value of Analog Input #1: a voltage or temperature. Therefore, a discrete input parameter must be programmed with only a discrete output code, and an analog input parameter must be programmed with only an analog output code.

ATTENTION

The function block SYSTEM PARAMETER, abbreviated SY, does not have input parameters or function block parameters like the other function blocks; SY produces output codes only. These output codes, shown in Table 3-4, are mostly values or states that indicate the status of system-wide parameters. For example, if any Alarm function block's output status is ON, the SY function block's AG (alarm global) output code is also ON.

Another example is the SY F1 output code, which produces a quick ON-to-OFF discrete signal when the F1 key is pressed. This SY F1 can be used as a trigger to another action. **For example, to allow an operator to start the Profile or reset the Totalizer by pressing the F1 key, you can program a Setpoint Profile's Start parameter or a Totalizer's Reset parameter with SY F1.**

Table 3-4 Function Block Parameter Designators

Functio Block Type	Function Block Name	Output code	Parameter Name	Paramete Type
AI	Analog Input	OV	Output Value	Analog
SY	System Parameter	RT	Reference Junction Temp.	Analog
		AG	Alarm Global	Discrete
		AH	Alarm High	Discrete
		AL	Alarm Low	Discrete
		DF	Diagnostic failure	Discrete
		DG	Diagnostic General	Discrete
		SF	Storage Full	Discrete
		SW	Storage Warning	Discrete
		AX	Analog Safe Parameter	Analog
		DX	Discrete Safe Parameter	Discrete
		F1	F1 or Start Key on keyboard	Discrete
		F2	F2 or Hold Key on keyboard	Discrete
		F3	F3 or Reset Key on keyboard	Discrete
		F4	F4	Discrete
		F5	F5	Discrete
AO	Analog Output	OV	Output Value	Analog
		BC	Back Calculation Value (Feedback)	Analog
		S2	Process Variable (AO's input)	Analog
DI	Discrete Input	OS	Output State	Discrete
DO	Discrete Output	OS	Output State	Discrete
LP	Control Loop	OV	Output Value	Analog
		PV	Process Variable	Analog
		DV	Deviation Value	Analog
		WS	Working Setpoint	Analog
		S1	Setpoint #1 Value	Analog
		S2	Setpoint #2 Value	Analog
		BC	Back Calculation Value (Cascade feedback)	Analog
		AM	Auto/Manual Status	Discrete
		SS	Setpoint #1/Setpoint #2 Status	Discrete
	ON/OFF Loop only	OS	Output Status	Discrete

Table 3-4 Function Block Parameter Designators (continued)

Functio Block Type	Function Block Name	Output code	Parameter Name	Paramete Type
SP	Setpoint Profiler	OV	Output Value	Analog
		A1	Auxiliary Output Value	Analog
		PV	Process Variable (Guaranteed Soak PV #1)	Analog
		SN	Segment Number	Analog
		SH	Hold Status	Discrete
		SE	End Status	Discrete
		SA	Active Status	Discrete
		SI	Active or Hold Status	Discrete
		SR	Ready Status	Discrete
		E1	Event#1 Output	Discrete
		thru	thru	
		E9	Event#9 Output	
		EA	Event#10 Output	↓
		EB	Event#11 Output	
		thru	thru	
		EG	Event#16 Output	Discrete
AL	Alarm	PV	Process Variable (alarm's input)	Analog
		S2	Compare Point (of Deviation alarm)	Analog
		OS	Output Status	Discrete
CN	Constant	OV	Output Value	Analog
		PV	Process Variable (Constant's input)	Analog
CV	Calculated Value*	OV	Output Value	Analog
		PV**	Process Variable	Analog
		A(n)	Analog Output #n	Analog
		BC	Back Calculation	Analog
		S2	Auxiliary input (link to totalizer preset)	Analog
		D(n)	Discrete Output	Discrete
		OS	Output Status	Discrete
*CV output codes are available for programming only if the CV has been programmed. For example, you cannot program an input parameter with CV1 OV unless CV1 has been programmed. **Input to the following CV types: Peak Pick, 1 Point Block Avg., 1 Point Rolling Avg., Scaling, Signal Select				
TL	Totalizer	OV	Output Value	Analog
		PV	Process Variable (Totalizer's input)	Analog
		OS	Output Status	Discrete
		S2	Preset Value	Analog

3.11 How to program input parameters

A function block has two types of programmable parameters: input parameters and function block parameters. When in a function block's Program menu, if a menu item has choices OFF, a number, or PARM, then the menu item is an input parameter to that function block. That is, if you choose PARM you can connect the input parameter to another function block's output code.

How to connect an input parameter to another function block

One way to program an input parameter is to connect it to an output parameter from another function block. We will show you this procedure using a specific function block's input parameter, but the keystrokes used in the procedure will apply when you are making any input parameter connection.

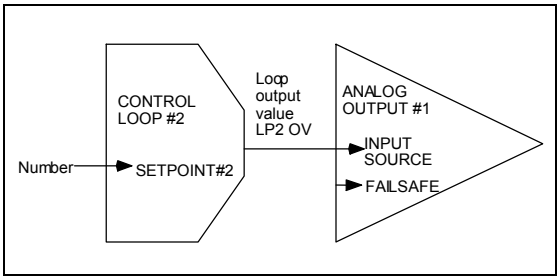


Figure 3-8 Example Input Parameter Connection

Assume we want to make the connections shown in Figure 3-8. We want Analog Output#1, a current output, to get its input from Control Loop#2's output value. Therefore, we must program Analog Output#1's Input Source parameter with the output code that represents Control Loop#2's output value. The following procedure shows how.

Table 3-5 Output Code Connection Procedure

Step	Action
1	In the Program Analog Output menu, select ANALOG OUTPUT#1.
2	Consult the Program Analog Output section of this manual to learn about the menu item you wish to change, namely, INPUT SOURCE.
3	Press Down Arrow button to move the cursor to the menu choice INPUT SOURCE.
4	Press Enter to move the cursor to the right side of the display where the choices for INPUT SOURCE are.
5	Press Up Arrow until PARM is displayed. If you press too many times and a number is displayed, continue pressing Up Arrow until PARM is displayed again. If you press Down Arrow while the number is displayed, the instrument assumes you want to enter a number, not a parameter. If you pressed Down Arrow, you must press Menu, then press Enter, then Up Arrow until PARM is displayed.
6	Press Enter to select PARM, which gives you choices for output codes to connect to. Figure 3-9 shows the format for all output codes.
7	Press Up Arrow or Down Arrow until LP is displayed. From Table 3-4, we know LP is the designator for the Control Loop function block type.
8	Press Enter to select LP.
9	Press Up Arrow or Down Arrow until 2, the Control Loop number we want, is displayed.
10	Press Enter to select 2.
11	Press Up Arrow or Down Arrow until OV is displayed. From Table 3-4 we know OV is the output code for the Control Loop's output value.
12	Press Enter to select OV. The cursor moves to the left and the connection from LP2 OV to Analog Output#1's INPUT SOURCE has been made.

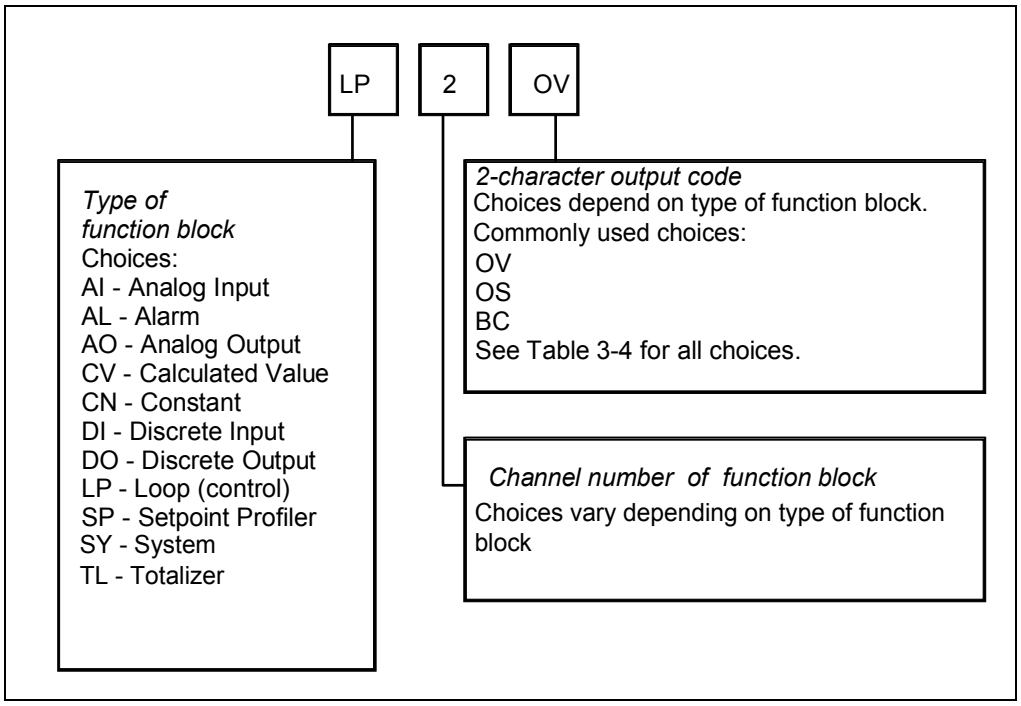


Figure 3-9 Function Block Connection Format

Before programming a function block's input parameter with a CV's (Calculated Value) output code, you must program the CV first. Otherwise, the CV's output parameter will not be available for programming.

The function block SY (System Parameter) operates internally and cannot be programmed. It automatically produces outputs which reflect the status of alarms, data storage, diagnostics, and reference junction temperature. These outputs can be used as inputs to function blocks.

How to program an input parameter with a number

Besides connecting an input parameter to another function block, you can program an input parameter with a number. The instrument will accept -999,999 to 9,999,999.

Continuing with the previous example, assume we want Loop #2's Setpoint #2 to be a number. Therefore, we must program Loop #2's Setpoint #2 parameter with a number, say 95. The following procedure shows how.

Table 3-6 Example Number Selection Procedure Using Front Panel Buttons

Step	Action
1	In the Program Control Loops menu, select LOOP #2.
2	Consult the Program Control Loops section of this manual to learn about the menu item you wish to change, namely, SETPOINT #2.
3	Press Down Arrow button to move the cursor to the menu choice SETPOINT #2.
4	Press Enter to move the cursor to the right side of the display where the choices for SETPOINT #2 are.
5	Press Up Arrow until NUMBER is displayed. Press Enter.
6	The rightmost digit will slowly flash on and off, indicating the cursor position. Since we want to change the number to 95.00, press the Left Arrow until the ones digit flashes. The Left Arrow moves the cursor to the left.
7	Press Up Arrow to change the 0 to a 5.
8	To change the tens digit, press Left Arrow to move the cursor one place to the left.
9	To change the 0 to a 9, press Up Arrow nine times.
10	At this point, 95.00 should be displayed with the 9 flashing. Since 95.00 is the value we want, press Enter to select it. The cursor moves left to the SETPOINT #2 prompt and the value is selected.

ATTENTION

To enter a number with a connected keyboard, instead of steps 5-10 simply type in the number 95 and press Enter.

How to program a discrete input parameter with a number

Table 3-6 shows how to connect Setpoint #2, an analog parameter, to a number. You can also connect a discrete parameter to a number. A discrete parameter, such as an alarm's input source, can be connected to any discrete parameter type in Table 3-7, or it can be programmed with a 0 to signify the off state or with a 1 to signify the on state. Enter a value of 1 or 0. For example, if you program an alarm's input source (Figure 3-7) with a value of 1, the alarm's output (AL1 OS) will always be on.

To program a discrete parameter with a 1 or 0, perform the following procedure. The procedure uses Alarm1's Input source as the parameter being programmed.

Table 3-7 Example Programming Discrete Input Parameter with a Number

Step	Action
1	In the Program Alarms menu, select ALARM #1.
2	Consult the Program Alarm section of this manual to learn about the menu item you wish to change, namely, INPUT SOURCE.
3	Press Down Arrow to move the cursor to INPUT SOURCE.
4	Press ENTER to move the cursor to the right side of the display where the choices for INPUT SOURCE are.
5	Press Up Arrow until 1 or 0 is displayed.
6	Press ENTER to select. The cursor moves to the left and the display indicates your choice of 1 or 0 has been made.

ATTENTION

Note the difference between programming a discrete parameter with OFF and programming it with a 0. “OFF” means “not connected”; 0 means “off state”.

3.12 How to program function block parameters

The second type of programmable parameter is a function block parameter. A function block parameter’s data is contained within a function block and cannot be connected to another function block. When you are programming a function block and are not given a choice of PARM, you are programming a function block parameter. Typical choices when programming a function block parameter are NONE, OFF, any numerical value, or a list of options—but not PARM.

Programming procedure

Here is the procedure for programming a function block parameter. It is an example using a specific function block parameter, but the keystrokes used will apply when you are programming any function block parameter.

Continuing with the example from Figure 3-8, assume we want Analog Output#1 to default to its lowest value if the input source, LP2 OV, fails. Therefore, we must program Analog Output#1’s failsafe parameter with the appropriate selection. The following procedure shows how.

Table 3-8 Example Function Block Parameter Selection Procedure

Step	Action
1	In the Program Analog Output menu, select ANALOG OUTPUT#1.
2	Consult the Program Analog Output section of this manual to learn about the menu item you wish to change, namely, FAILSAFE.
3	Press the Down Arrow button to move the cursor down to FAILSAFE.
4	Press Enter to move the cursor to the right side of the display where the choices for FAILSAFE are.
5	Press Up Arrow or Down Arrow until DOWN is displayed.
6	Press Enter to select DOWN. The cursor moves to the left and DOWN is selected.

3.13 How to program a simple configuration

This section describes how to program your instrument. You should practice doing these procedures until you are familiar with the buttons and menus.

Table 3-9 Function Block Configuration Procedure

Step	Action
1	Select the desired function block from the Program menu.
2	Program each of the function block’s input parameters with OFF, a number, or an output code from another function block. See section 3.11 for this procedure.
3	Program each function block parameter with a number, selection, NONE, or OFF. See section 3.11 for this procedure.

Continued

Table 3-9 Function Block Configuration Procedure (continued)

Step	Action
4	Program the function block's other items as desired. Other items include decimal point positions, descriptor, tag, and various labels for identifying the function block.
5	Repeat steps 1-4 for all desired function blocks until the instrument is configured.

Example configuration

Figure 3-10 shows a simplified configuration using typical function block connections. Note that several parameters are left out to simplify the drawing and procedure.

Table 3-10 describes how to program these connections.

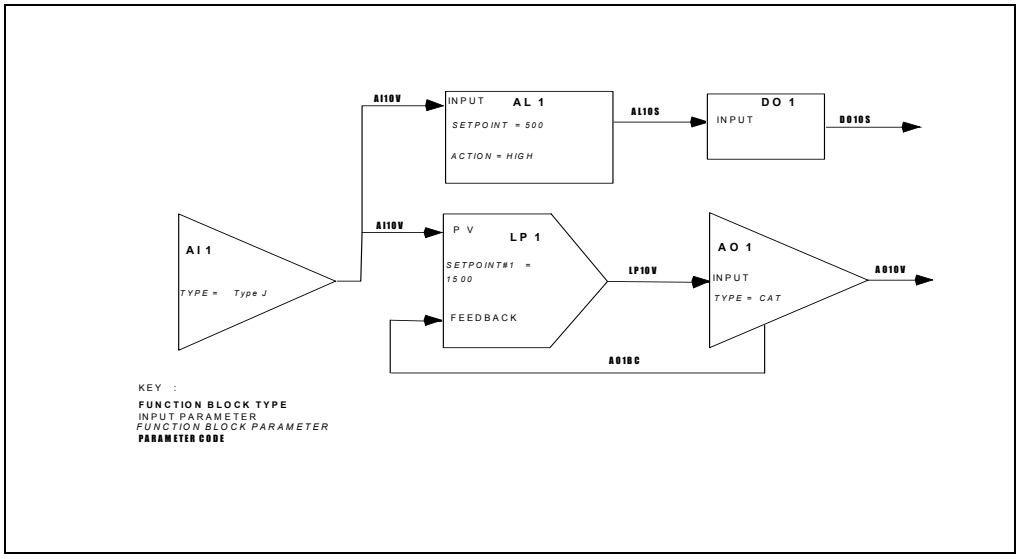


Figure 3-10 Example Configuration

Table 3-10 Example Configuration Procedure

Function block type (**Full name as displayed in the Program menu**) 1. Select this menu item from the Program menu.	2. Select this input parameter from the function block's menu...	...and program it with this output code. See Section 3.11 for details.	3. Select this Function block parameter from the function block's menu...	...and program it with this choice. See Section 3.12 for details.
AI 1 (**ANALOG INPUT #1**)	--	--	TYPE	TYPE J
LP 1 (**LOOP #1**)	PV	AI1 OV	SETPOINT#1	1500
	FEEDBACK	AO1 BC		
AL 1 (**ALARM #1**)	INPUT	AI1 OV	SETPOINT	500
			ACTION	HIGH
DO 1 (**DISCRETE OUTPUT #1**)	INPUT	AL1 OS	--	--
AO 1 (**ANALOG OUTPUT #1**)	INPUT	LP1 OV	TYPE	CAT

3.14 How to program common configurations

Being able to diagram a control configuration in terms of function blocks makes it easier to program and configure your instrument for its intended process control application. This function block diagram you create can be used as a "construction blue print" to program the instrument. Each block in the diagram relates to a dedicated instrument programming menu in the instrument's PROGRAM mode.

What follows are examples where common control configurations are presented along with their function block diagrams. The first example is a simple control arrangement in great detail to help you understand function block diagram basics, followed by more sophisticated examples. Once you understand how to diagram function blocks, you will be able to draw a diagram for virtually any control strategy regardless of complexity. Understanding the relationship between such diagrams and the instrument's programming menus is key to successfully mastering the instrument's many capabilities and features.

Programming a Current Driven Heat Treat Element

An example of one of the most common and simple control strategies is in Figure 3-11 below.

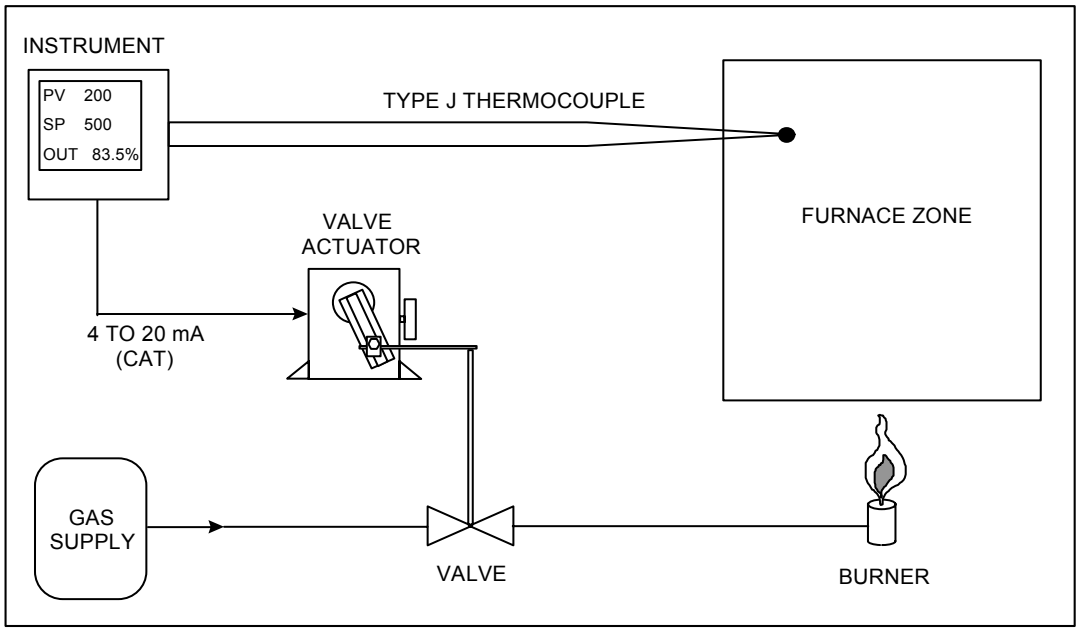


Figure 3-11 Control Of Furnace Zone Temperature With 4-20 mA (CAT) Control Signal

1. Diagram the function blocks

To configure this application using the instrument, your task is to build up a simple current control loop. Note that this control loop must monitor and control the temperature of the furnace zone to a local set point of 500 ºF. Using a 4 to 20 mA signal applied to a gas valve actuator, the furnace zone's temperature will be controlled by regulating the flow of gas to the zone's burner. The instrument will measure temperature, in a range between 0 and 1000 ºF, by means of a Type J thermocouple.

To support this application, a 4 to 20 mA control loop with a thermocouple process variable must be configured. Three function blocks—one for specifying a thermocouple analog input, a second for a standard PID control loop, and a third defining a 4 to 20 mA analog output—are needed to produce this control strategy's function block diagram.

Each function block should first be arranged as in Figure 3-12. Analog input and output function blocks are represented by right-pointed triangles. Control loop function blocks are represented by right-pointed parallelograms.

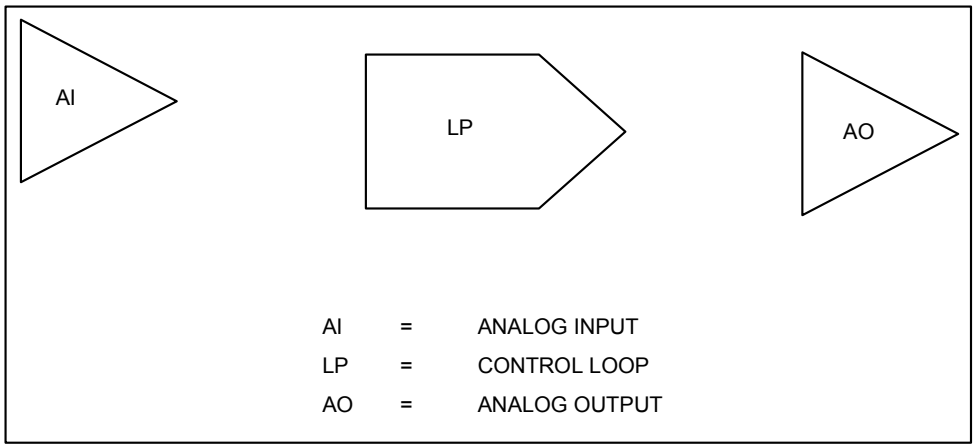


Figure 3-12 Basic Function Blocks Required For Control Configuration Of Figure 3-11

2. Label input parameters

Properly label each function block. First, assign to each function block a name that identifies it within the hardware and feature capacities of the instrument being worked with. You may assign any of the analog inputs, control loops, and analog outputs that your instrument has to the blocks comprising the function block diagram drawn. For simplicity, AI1, LP1, and AO1 will be used in this example. Refer to Figure 3-13. Note that AI5, LP2, and AO2 could just as easily have been used.

3. Label output parameters

The second part in labeling each function block is to denote the blocks' major input and output parameters. Each of these parameters will correspond to actual menu settings that you program on the instrument. As shown in Figure 3-13, the AI1 function block's input parameter will be the actual Type J thermocouple run from the furnace to the instrument's AI1 input terminals. The AI1 block will process the thermocouple's millivolt signal to generate a temperature measurement. AI1's output value, denoted "AI1 OV", will essentially be the furnace zone temperature. The LP1 function block is shown, for now, with one input denoted by "PV". Here, the control loop block will expect to find the data comprising its process variable. The LP1 block's single output is the loop's main control output. Denoted "LP1 OV (Loop 1's Output Value)", it will range between 0 and 100%. The value of LP1 OV at any given instant will be determined by the control loop function block's PID algorithm.

The last block in the diagram is the analog output function block, AO1. Drawn at this point with just a single input and output, its primary purpose will be to generate a 4 to 20 mA signal that linearly corresponds to whatever value is applied at its input. For example, if AO1's input is defined as some value that ranges from 0 to 100%, an input value of 0% will cause AO1 to generate a 4 mA signal at the instrument's AO1 output terminals. A 12 mA signal will be generated in response to an input of 50%, while 20 mA will result when a 100% input value is applied. AO1's input parameter is denoted "IN", with its output parameter labeled to identify it as the physical 4 to 20 mA signal detectable at the pair of instrument rear terminals dedicated to AO1.

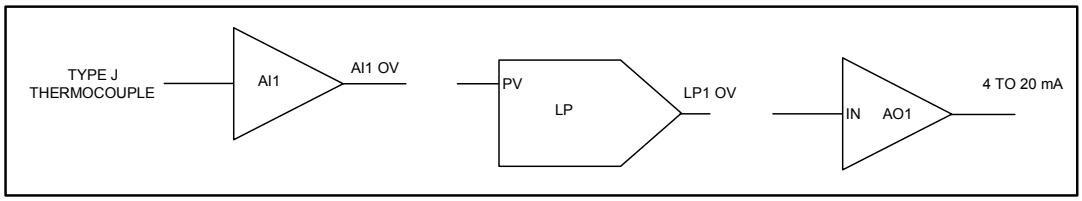


Figure 3-13 Labeling Each Function Block's Name And Major Inputs And Outputs

4. Label function block parameters

Finally, label each block's internal parameters. "Internal parameters" may also be referred to as "function block parameters." As in the case of input and output parameters, internal parameters associated with each block correspond to actual menu settings you program in the instrument. While input and output parameters constitute either data exchanged between function blocks or physical signals exchanged between the instrument and the outside world, internal parameters are settings that uniquely define the operation of the function block they are associated with. Use of a function block's internal parameters is for the most part limited to within the operations of the function block itself.

It is not always possible, or even practical, to draw every internal parameter that a function block has or might need. Therefore, as a rule-of-thumb for starting out, you should first think of internal parameters as simple labels that further define and clarify the internal operation of the function block. With this rule-of-thumb in mind, internal parameters become items that are hopefully intuitively obvious. At this point, what may or may not be an "intuitively obvious" internal parameter will depend on your level of process control expertise. For the function block diagram built up so far, internal parameters that can be presumed from the control strategy of Figure 3-11 are indicated in Figure 3-14. Here, the AI1 function block has been labeled to show that its "INPUT TYPE" will be a Type J thermocouple with a measurement range between 0 (RANGE LOW) and 1000 ºF (RANGE HIGH). The label "STANDARD" has been used to indicate the type of control loop LP1 will be, along with the notation "SP = 500" to show that the loop's set point will be 500 ºF. The loop tuning constants of GAIN, RESET, and RATE have been initially indicated as 10, 1 repeat/minute, and 0 minutes, respectively. As far as the AO1 function block is concerned, its input range has been defined between 0 (IN LOW LIMIT) and 100 (IN HIGH LIMIT) in anticipation of using LP1's output to drive the 4 to 20 mA signal it will generate. Note how AO1's output range has been defined through use of the notation "OUT LOW LIMIT = 4" and "OUT HIGH LIMIT = 20."

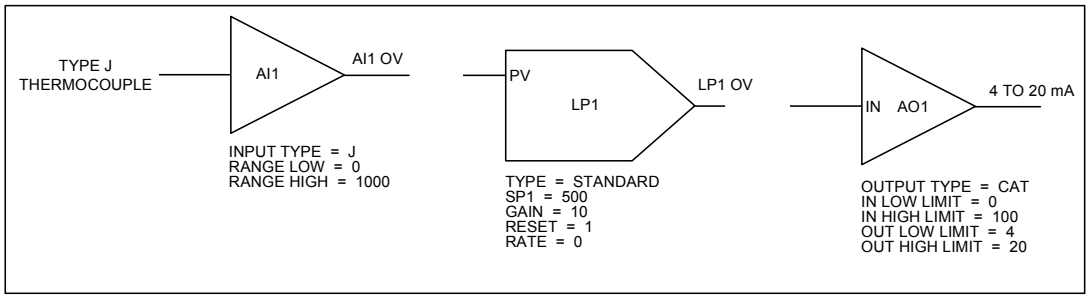


Figure 3-14 Labels For Internal Function Block Parameters

Note that the internal parameters that we have specified in the function block diagram built up so far are based largely on what can be inferred from the elements of the control configuration depicted in Figure 3-11. These internal parameters will relate directly to settings found in instrument programming menus that exist for each particular function block. As your experience and familiarity with programming the instrument increases, you will become more familiar with some of the less intuitive parameters and you will include these in your diagrams.

5. Connect the blocks

The next step is to connect the function blocks in the diagram. Refer to Figure 3-15. The interconnection lines drawn depict the flow of information between function blocks and represent how the blocks work together to support the complete control strategy. As shown, the furnace zone temperature measurement that AI1 generates will essentially be used as the process variable of the LP1 control loop. Based on the values of the loop's tuning constants and on how far AI1 OV deviates from the 500 ºF set point, the control loop function block's PID algorithm will accordingly adjust LP1 OV to whatever value will be necessary to maintain the process' set point. LP1 OV, which ranges from 0 to 100 %, will in turn be applied to AO1's input to drive the 4 to 20 mA control signal applied to the valve actuator. By modulating the valve actuator's position, this 4 to 20 mA signal will regulate the gas flow to the furnace zone burner and thereby allow the instrument to control the heat levels measured in the zone.

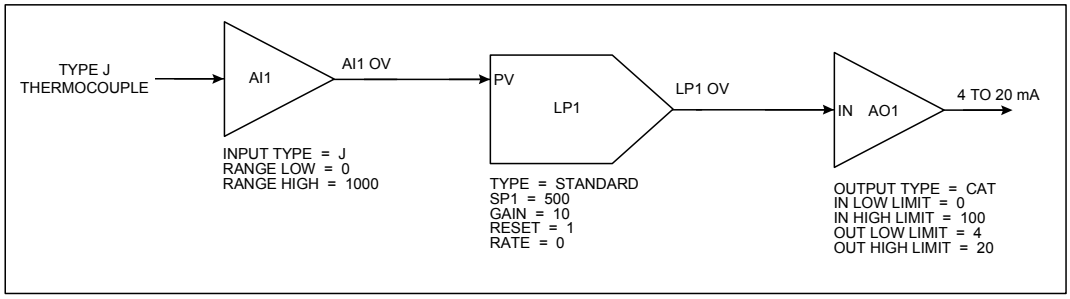


Figure 3-15 Interconnections Between Function Blocks

6. Draw the Feedback connection

To fully complete the function block diagram, one final and very important interconnection must be drawn. In setting up control loops in this instrument, a feedback path must be specified between the loop function block itself and the hardware element that externalizes the loop's output to the real world. That is, the control loop block needs confirmation from the analog output block connected to it that the percent output levels it calls for have been correctly translated into accurate output signals. The feedback path that provides LP1 with this confirmation is established by means of program settings depicted in Figure 3-16.

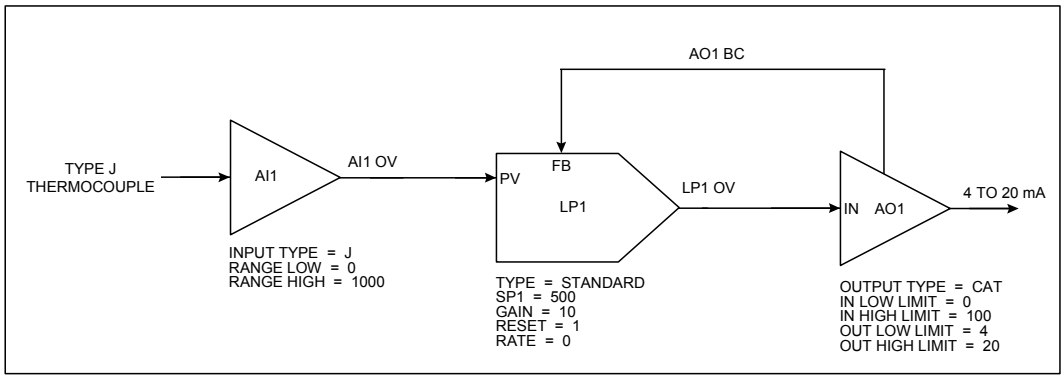


Figure 3-16 Complete Function Block Diagram Of Figure 3-11

Here, the function block diagram is drawn to include the key components of a typical loop feedback path. The AO1 function block has been changed to feature a second output denoted "AO1 BC." This output has been connected to a feedback input at LP1 identified by the notation "FB." The "AO1 BC" designator stands for "Analog Output 1's Back Calculation." When the control loop is brought on-line, AO1 BC will essentially represent the value of AO1's 4 to 20 mA output at any particular instant. The term "Back Calculation" is used to reinforce the idea that this information is being sent "upstream" against the flow of all other information within the function block diagram.

Time Proportioning Relay Driven Pump

A second control scheme is to use a relay to produce a time proportioning or Duration Adjusting Type (DAT) control signal. Such an application is depicted in Figure 3-17.

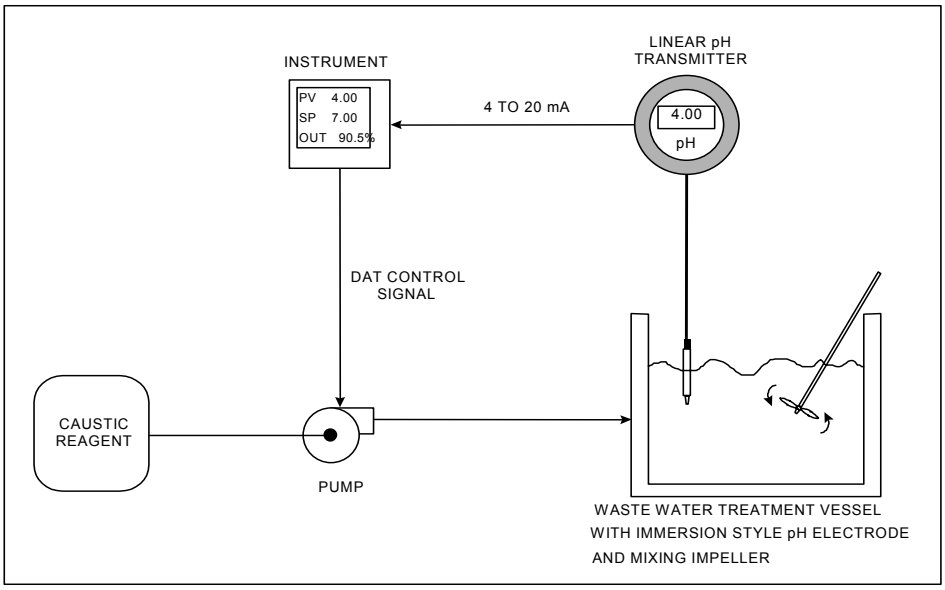


Figure 3-17 Control Of Wastewater pH Using A Time Proportioning (DAT) Control Signal

This application requires a basic time proportioning control loop to monitor and control the pH of the wastewater to a local set point of 7 pH units. That is, the loop will "neutralize" the wastewater so that it can be safely released to the environment. The wastewater pH, which is assumed to be primarily acidic, will be controlled by introducing a caustic reagent to the contents of the treatment vessel. This will be done through use of a time proportioning relay signal that will pulse a pump connected to a caustic reagent source.

A function block diagram representing the control scheme of Figure 3-17 has been drawn in Figure 3-18. The same diagram method was used to produce Figure 3-16.

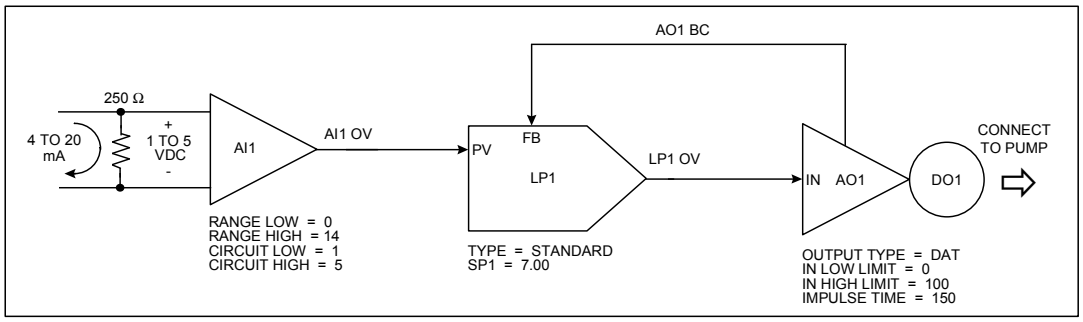


Figure 3-18 Function Block Diagram Of Figure 3-17

This drawing is similar to the temperature control application. The analog input, control loop, and analog output function blocks (AI1, LP1, and AO1) have been used similarly. The discrete output function block was added, drawn as a circle at AO1's apex and named "DO1." Recall that any analog input, control loop, analog output, or discrete output available may be used. Up to 36 discrete outputs (DO1 through DO36) are potentially available depending on the instrument's model number.

From Figure 3-18, the instrument's AI1 function block will essentially process the 4 to 20 mA transmitter signal to generate a pH measurement. This measurement will be "AI1 OV" which, in turn, will be applied to LP1's process variable input, "PV." Before the 4 to 20 mA signal is applied to AI1, it will be converted to a 1 to 5 VDC signal with a 250 Ω shunt resistor. AI1 will be configured to generate a pH measurement in a range from 0 (RANGE LOW = 0) to 14 (RANGE HIGH = 14) in response to a voltage input between 1 (CKT LOW = 1) and 5 (CKT HIGH = 5) VDC. The PID algorithm of the control loop function block will adjust the value assumed by LP1 OV between 0 and 100%. This 0 to 100% signal will be applied to AO1, which will be configured as a DAT type analog output. The internal parameter of "IMPULSE TIME" in AO1 is the DAT analog output's cycle time or period. With a specified impulse time of 150 seconds (an arbitrarily picked value), the DAT output will be ON for 75 seconds and OFF for 75 seconds when the input from LP1 is set to 50%. The ON and OFF times will be determined completely by the % output levels called for by LP1. Finally, to externalize the ON and OFF output states of AO1 to the outside world, the DO1 output relay, represented by the DO1 function block, will be programmed for AO1's exclusive use. Hence, as AO1 switches between ON and OFF states in response to LP1 OV's % output levels, so too will the DO1 output relay to generate the pulses required to drive the caustic reagent pump.

Split Output or Duplex Control

Split output or duplex control loops are typically used in heat/cool applications. Temperature is controlled through simultaneous use of both heating and cooling elements. If the instrument was to support a heat/cool control configuration, an example of the control scheme that might be dealt with is illustrated in Figure 3-19.

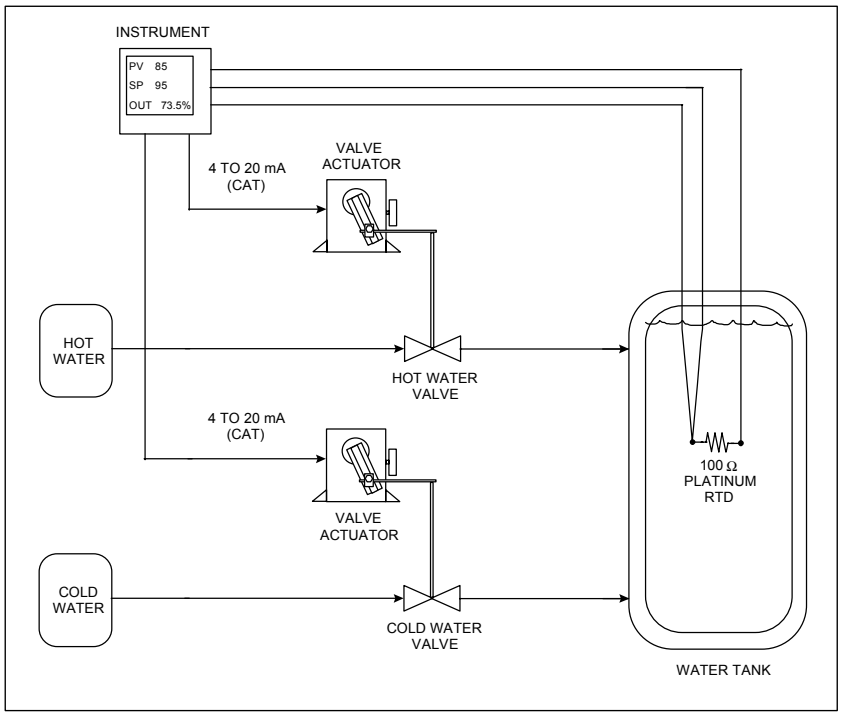


Figure 3-19 Temperature Control Of Water Using Split Output Or Duplex Control

The instrument must be set up to produce two 4 to 20 mA control signals. By applying them to current-controlled valve actuators coupled to hot and cold water valves, these signals will regulate the amount of hot and cold water introduced to the vessel to maintain the water temperature at whatever set point will be programmed. The temperature of the water will be measured by means of a three-wire 100 Ω Platinum RTD. This process may be likened to manipulating hot and cold faucets regulate water temperature.

In Figure 3-20, the analog input function block AI1 is depicted processing the resistance values produced by the RTD. The resulting water temperature measurements (AI1 OV) are then fed to the process variable input (PV) of the LP1 control loop block. Note how LP1 has been defined as a split output control loop using the notation "TYPE = SPLIT." Unique to this control loop is the defined range of its output value, LP1 OV. Where the standard control loops mentioned thus far have had outputs ranging exclusively between 0 and 100%, the % values of the split output control loop vary between -100 and 100. 0% is considered the midpoint for this control loop's output range. When brought on-line, a 0 to 100% output value will be generated by LP1 when hot water is needed to maintain the temperature at set point. When the addition of cold water is necessary, the loop's output will assume a value between 0 and -100%. Note that to externalize the control signals generated by LP1, two analog output blocks, AO1 and AO2, will be used. AO1's 4 to 20 mA signal will be tied to the hot water valve actuator, while the actuator that adjusts the position of the cold water valve will receive its mA control signal from AO2. To provide AO1 and AO2 with usable input driving signals, LP1's output will be applied to a function called a "standard splitter (STD SPLITTER)." Made from one of the instrument's calculated value function blocks ("CV's"), the standard splitter will essentially be a mechanism that translates the % values of the split output control loop into two distinct 0 to 100% signals. They will be applied to the inputs of AO1 and AO2 and, as such, will drive and linearly correspond with AO1 and AO2's 4 to 20 mA outputs.

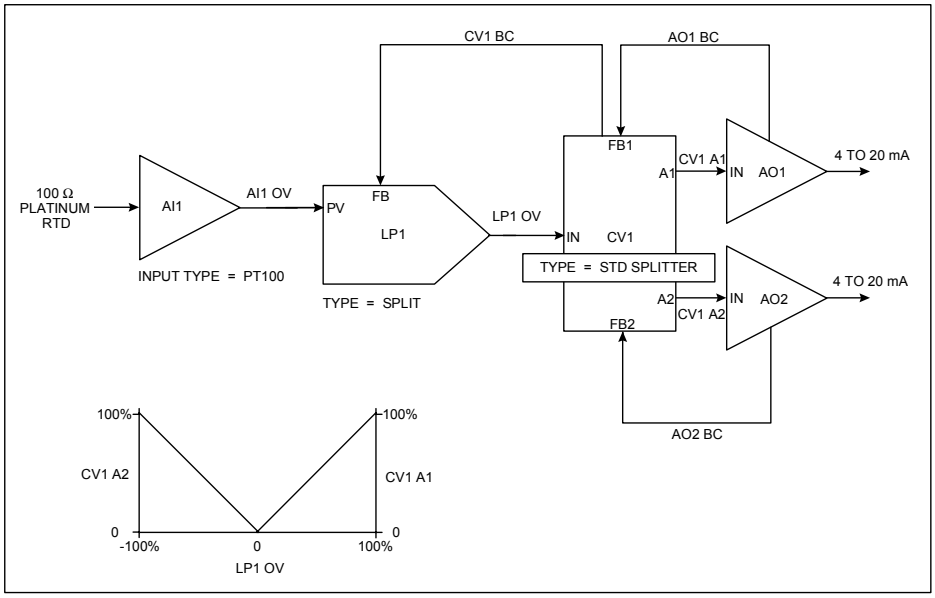


Figure 3-20 Function Block Diagram Of Figure 3-19

The two outputs on CV1 that will drive AO1 and AO2 are respectively labeled "CV1 A1" and "CV1 A2." CV1's basic operation is described by a plot of these outputs versus LP1 OV. Shown in the lower left of Figure 3-20, the plot demonstrates that CV1 will produce a 0 to 100% value at its CV1 A1 output when LP1 calls for an output level between 0 and 100%. CV1 A2 will remain at 0%. When applied to AO1, the CV1 A1 value will activate the 4 to 20 mA signal needed at the hot water valve actuator to make the water temperature in the vessel rise. Similarly, when LP1 calls for an output level between 0 and -100%, CV1 will produce a corresponding 0 to 100% value at CV1 A2. This time, CV1 A1 will remain at 0% and the CV1 A2 value generated will induce the introduction of cold water into the vessel to cool its contents down.

Note the function block diagram's use of three back calculated feedback paths. Two such paths are labeled AO1 BC and AO2 BC. They are connected to CV1 from the analog output function blocks at inputs denoted "FB1" and "FB2." CV1 BC, the third feedback path, runs from CV1 to the FB input of LP1. All three feedback paths work together to acknowledge to LP1 that the appropriate output signals have been generated in response to the % output levels the loop has called for.

Cascade Control

An example of a cascade control application is featured in Figure 3-21. Cascade control is typically used when two process values must be simultaneously controlled, with one process value directly influencing the behavior of the other. In this control strategy, each process value is supported by its own dedicated control loop. The term “cascade” is used because it describes how this control approach literally attaches both control loops together. This act of linking control loops allows for the regulation of both process values using one and only one % output control signal.

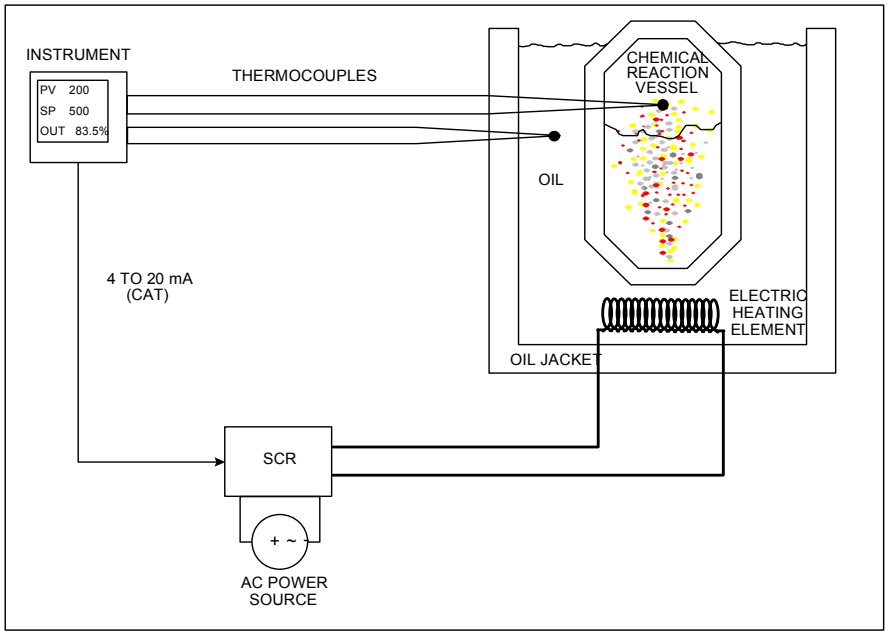


Figure 3-21 Temperature Control Of An Oil Heated Chemical Reaction Chamber

InFigure 3-21, the temperature in a chemical reaction chamber is determined by the temperature of the heated oil surrounding it. Heating the oil is done by an electric heating element driven by a 4 to 20 mA controlled SCR and external power source. In this application the instrument controls the temperature of the chemical reaction chamber through control of the heat emitted by the jacket tank oil. The instrument must provide a single 4 to 20 mA control output to govern the voltage switched by the SCR and, hence, the heat applied to the entire system. Temperature is monitored with thermocouples.

The function block diagram of the required instrument configuration is featured in Figure 3-22

Note that this diagram illustrates the classic cascade arrangement of two control loops that defines the cascade control strategy. The first control loop, LP1, is designated as the primary cascade loop by the notation “CAS_P.” The notation “CAS_S” indicates LP2’s designation as the secondary cascade loop. Note how both control loops are joined together. In addition to the back-calculated feedback path set up between the two (LP2 BC), LP1’s output is connected to an input on LP2 that at this time must be introduced. Denoted as SP2, this input is LP2’s remote set point input.

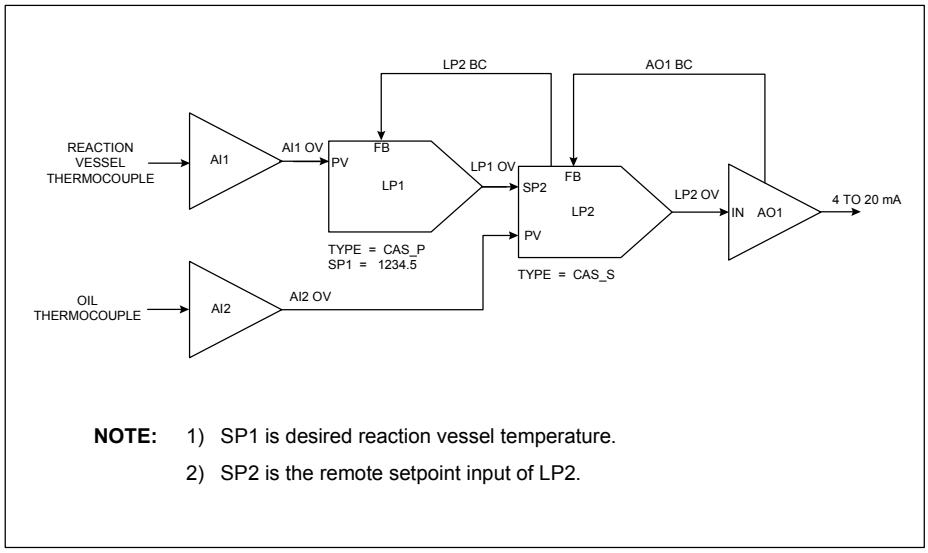


Figure 3-22 Function Block Diagram Of The Cascade Control Strategy

Recall that based on the instrument's model number, up to eight control loops (LP1 through LP8) are potentially available for use within the instrument. *All control loops in this product may be programmed to operate using up to <u>two</u> user defined set point parameters, designated by SP1 and SP2.* Should you implement a control loop using one or both setpoints? That depends on what is necessary to meet the requirements of the specific application being dealt with. When in the on line mode and viewing a control loop's dedicated on line display, the working set point of the live control loop can be switched between SP1 or SP2 by simply pushing the "SP" key on the instrument's front door. Note that while both set point parameters may be programmed to have straight numeric values, only SP2 may be defined as a remote set point. That is, SP2 may be set up so that its value is determined by the output value of another function block, such as a setpoint profile. In the cascade control strategy demonstrated in Figure 3-22, SP2's remote set point functionality is exploited by the LP2 secondary cascade loop. When this control configuration is made operational, LP2's working set point, SP2, will have a value determined by LP1 OV.

In Figure 3-22, the process values of each loop are the output values of the AI1 and AI2 analog input function blocks. AI1 will produce temperature measurements of the reaction chamber and provide them to the process variable input of LP1, while measurements of the oil temperature in the jacket tank will be furnished to LP2's PV input by AI2. Because LP1 OV will provide LP2 with its operating set point, LP1's output range will be defined in engineering units of temperature instead of the usual 0 to 100%. LP2's output range is 0 to 100%, in anticipation of using it to drive the AO1 function block's 4 to 20 mA signal. Note that the range covered by LP1 OV will have to be consistent with the operating temperature range of the oil. For example, if it is determined that the oil temperature will be manipulated between 75 and 500 ºF, the low and high limits assumed by LP1 OV (and, for that matter, SP2) will equal 75 and 500, respectively. Finally, LP2 BC and AO1 BC are the two back-calculated feedback paths shown. As is true for the operation of all back-calculated feedback paths, both LP2 BC and AO1 BC work together to acknowledge the cascaded control loops that the appropriate actions have taken place in response to both loops' output values.

The method used to coordinate the tuning of the cascaded loops is particularly interesting. Using the diagram of Figure 3-22, the first priority is to tune the secondary cascade loop of LP2. With LP1 kept in manual mode, tuning may begin by first placing LP2 in manual mode and then manipulating LP1's output. This will allow the generation of an LP2 set point that will induce a process upset when the secondary loop is placed back in automatic mode. Only after LP2 has been tuned can LP1 be tuned. When tuning LP1, LP2 will be kept in automatic mode throughout the entire time LP1 is exercised. Since the tuning of LP2 will have already been established, tuning LP1 may be approached by first mentally "blocking out" the secondary control loop's existence and visualizing LP1's output as connected to a sort of virtual analog output function block. In this light, tuning the overall cascade control configuration becomes the considerably simpler matter of tuning a single control loop.

Set Point Profile Implementation

By definition, set point profiles are essentially user specified plots of process values against time. These plots are characterized by “segments” which are a series of intervals of varying time lengths that divide the plots into several segments. Within each segment, process values are typically drawn as straight lines that ramp up or down or stay constant at predetermined levels. An example of a simple five-segment set point profile is shown in Figure 3-23. Set point profiles with up to 63 segments can be specified using the instrument. Note that when a segment depicts the process value as sloping up or down, it is referred to as a “ramp.” The term “soak” is used to describe a segment when the process value is made to stay constant. In Figure 3-23, segments 1, 3, and 5 are ramps while segments 2 and 4 are soaks.

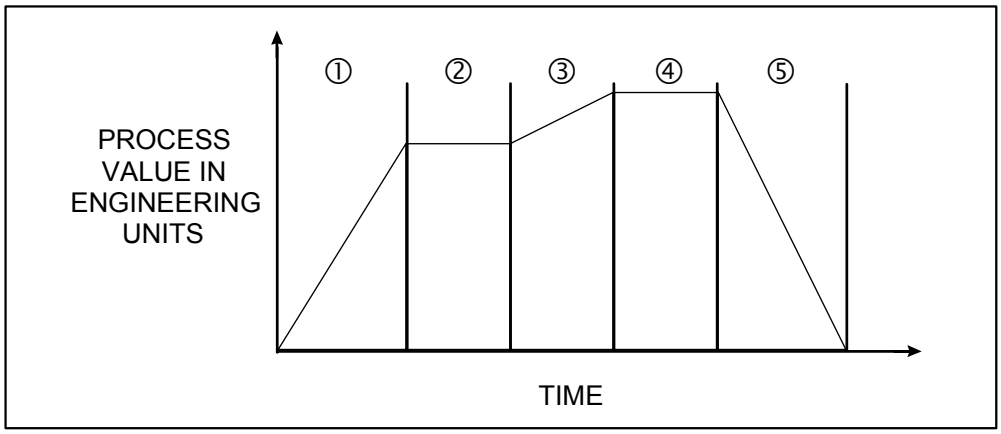


Figure 3-23 Example Set Point Profile

To force a process value to vary linearly with time at various rates within successive time intervals is the job of a set point profiler, another class of function blocks available within the instrument. Be advised that use of set point profilers is typically observed in thermal or heat treat applications. For example, being able to vary temperature in accordance with a set point profile is vital in the tempering of metal or ceramic parts.

Refer to the application of Figure 3-11 discussed at the beginning of this section. This application dealt with controlling a furnace zone’s temperature by means of a 4 to 20 mA gas valve actuator. If the furnace zone temperature were to be manipulated so that it followed the ramps and soaks of a set point profile, the first step would be to implement the function block diagram established in Figure 3-16In general, the control configuration that holds a process value to a local set point, must be programmed and on line before allowing the process value to be characterized by a profile. With regard to the application at hand, a set point profiler function block programmed with a user defined set point profile may be brought into the configuration once the furnace zone’s basic temperature control loop is operational. Note that the output of the profiler function block will essentially be the set point profile.

From the cascade control strategy’s explanation, recall that all control loop function blocks within the instrument have a Setpoint #2 parameter that may be used as a remote set point input for connecting to the profiler’s output.

LP1 in the function block diagram of Figure 3-16 will make use of SP2’s remote set point functionality so that a set point profiler’s time varying set point may be applied to it. Refer to Figure 3-24.

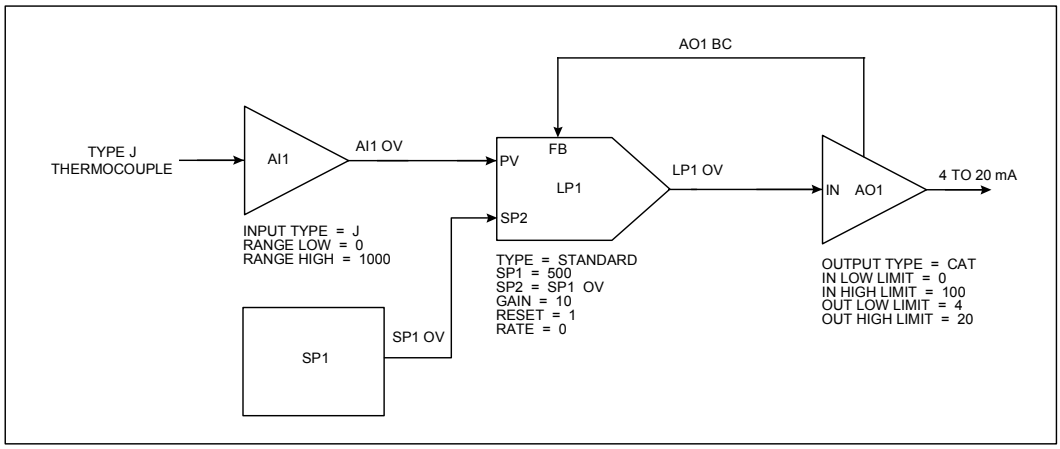


Figure 3-24 Function Block Diagram Of Set Point Profile Control Of Figure 3-16

Figure 3-24 basically depicts all the components of the Figure 3-16's control configuration with a set point profiler function block denoted by SP1. The profiler's output (SP1 OV) is connected to the remote set point input of LP1. Depending on the model number of the instrument, up to four set point profiler function blocks (SP1 through SP4) may be included within the instrument's feature capacities. Note that while the profiler of SP1 was specified in Figure 3-24's diagram, any of the profilers within the instrument could have been used.

When a set point profile is executed, discrete inputs are typically used in conjunction with external switches to control the set point profiler function block. For example, the set point profiler function block can be programmed to start, hold, or reset based on discrete input statuses. See Figure 3-25.

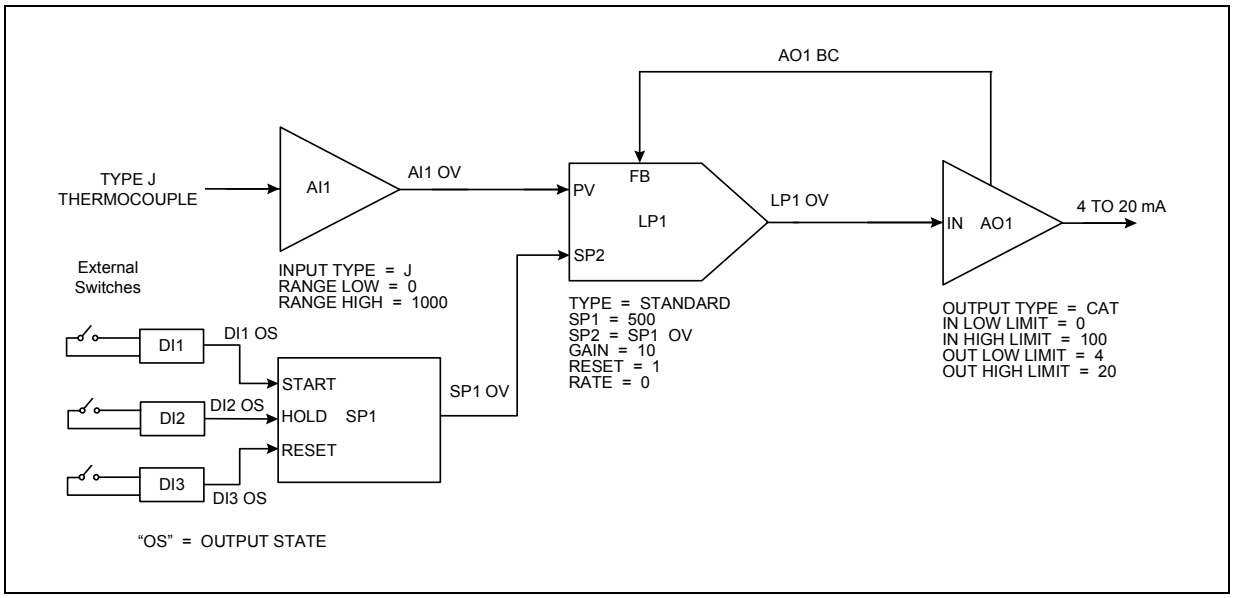
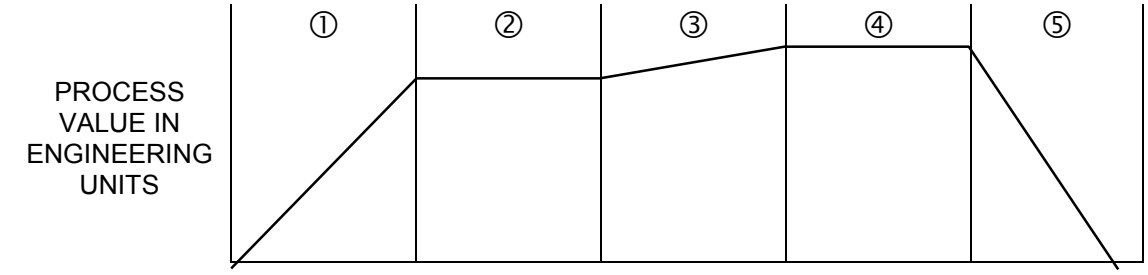


Figure 3-25 Discrete Inputs Controlling Execution Of Set Point Profiler Function Block

Also typical in the execution of a set point profile is the generation of discrete events during each profile step. Discrete events are simply status indicators that are programmed to assume either an ON or OFF state during a step of a profile. As simple discrete status indicators, these events may, for example, be used to initiate a logic control scheme on the process being controlled upon the occurrence of a particular profile segment. In this product, note that up to 16 discrete events may be programmed per segment. See Figure 3-26.



	SEGMENT #1	SEGMENT #2	SEGMENT #3	SEGMENT #4	SEGMENT #5
SP1 EVENT #1	ON	OFF	ON	ON	OFF
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
SP1 EVENT #16	OFF	ON	ON	OFF	ON

Figure 3-26 Up To 16 Discrete Events May Be Programmed Per Step Of A Set Point Profile

Discrete events, whose ON or OFF states depend on the step number of the profile they are associated with, may be externalized using the discrete output hardware available in the instrument. Figure 3-27features the function block diagram elements that represent how to program the instrument's discrete outputs so that their states coincide with those assumed by a profile's discrete events.

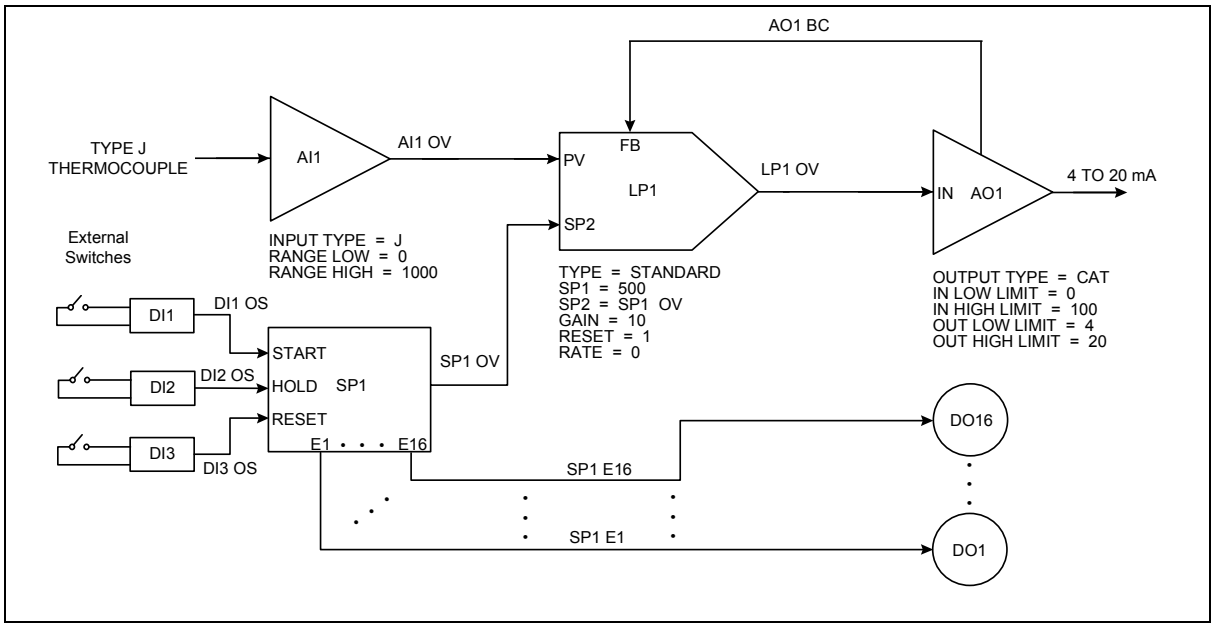


Figure 3-27 Tying A Profile Function Block's Discrete Events With Discrete Output Hardware

Refer to your instrument's model number to verify its complement of discrete input and output hardware. The available combinations of discrete inputs and outputs are featured in the Specifications section.

3.15 Data Storage

This instrument supports either floppy 1,44 MB or 100 MB ZIP disks. Note that only DOS formatted floppy disks may be used in the instrument's disk drive and the unit's front door must be closed for any disk drive operations to take place. The floppy disks may be initialized in the instrument or on an IBM-PC with the initialize utility.

Read this overview thoroughly to understand the fundamentals behind the instrument's data storage capabilities.

Categories of Stored Data

There are four categories of disk storable data. Each category of data is stored in its own unique file. The categories are:

Data Storage

Configuration Storage

Setpoint Program Storage

Calibration Storage

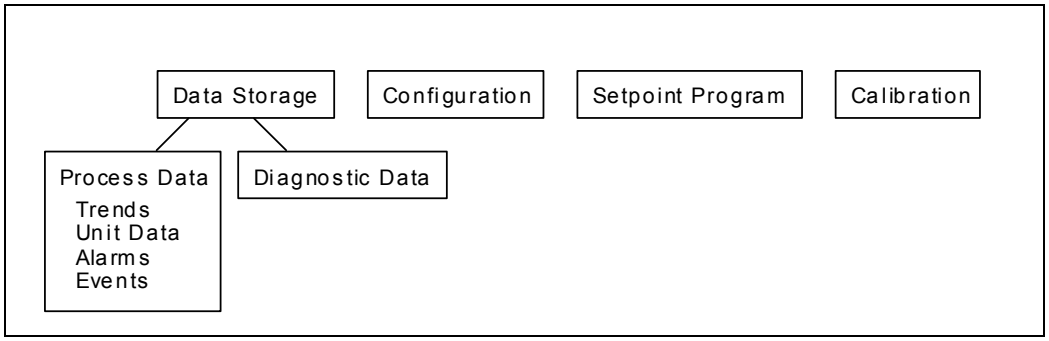


Figure 3-28 Categories of Stored Data

The first category of stored data, Data Storage, is comprised of two types of data: process data and diagnostic data. When the instrument stores these data types it is essentially functioning as a recorder.

Process data is comprised of up to four files containing historical information on the process that the instrument is monitoring and/or controlling, such as the temperature trend or a log of a furnace over time. Process data also includes any alarm or discrete event information.

Diagnostic data is the result of the instrument's execution of diagnostic routines during instrument start-up and maintenance procedures (such as calibration). Online operation is also monitored to detect both process faults and internal electronic errors. If a diagnostic error occurs, a record of it can be stored to a single diagnostic file.

The second category of stored data is configuration storage, which is a single file comprised of the instrument's programming and configuration. Configuration storage includes the programming of the instrument's analog input characteristics, the configuration of its control loops, or, perhaps, the programming of any math or logic functions.

The third category of stored data is Setpoint Program storage, which is a single file –a setpoint program– containing one to eight setpoint profiles, depending on the instrument. Recall that set point profiles are user specified plots of process values against time that are divided into ramp and soak segments of varying time lengths. Setpoint programs may be stored to disk or to the instrument's memory.

The fourth category of stored data is calibration storage, which is a file containing the instrument's analog input and output calibration. This file may be used to restore calibration in the event that a full calibration, using a calibration source and/or meter, cannot be performed.

Performing Data Storage

Configuring the instrument to store the first category, Data Storage (process and diagnostic data) is done through an Online menu entitled DATA STORAGE. All aspects of preparing a DOS formatted disk to accept process and diagnostic data information are managed through this menu's selections. Process and diagnostic data may be stored on the same disk, but not along with other storage types (i.e., configuration, setpoint programs, or calibration).

The four types of process data are:

Trends - Data comprising the classic horizontal or vertically oriented time-varying traces that represent process parameters.

Unit Data - Process parameter information collected and displayed in tabular or datalog format.

Alarms - A record of any alarms that activated while the instrument was monitoring and/or controlling your process.

Events - A record of any discrete events that might have occurred while the instrument was monitoring and/or controlling your process. Discrete events may occur, for example, in the instrument's execution of a set point profile.

When the instrument is On line and performing Data Storage, a separate and distinct disk file will be established for each process data type along with a file for diagnostic errors. Each file will be distinguished by a file extension as indicated in Table 3-11.

Table 3-11 Data Storage File Extensions

Data Type	File extension
Trends	.LNT
Unit Data	.LNU
Alarm History	.LNA
Discrete Event	.LNE
Diagnostics	.LND

You can specify which process data types are written to disk and whether or not diagnostic errors are stored by setting up data storage schedules, accessible under a prompt entitled SET UP NEW SCHEDULES under the DATA STORAGE menu. Up to Eight files may be written to disk while the instrument performs Data Storage – four trend files, one unit data file, one alarm file, one event file, and one diagnostics file.

SET UP NEW SCHEDULES lets you designate several other parameters, such as the data storage rate (i.e., the distance in time between adjacent samples of a recorded process data parameter), the eight-character file names used to identify each process and diagnostic data file, and whether or not the Data Storage takes place in continuous or batch modes. Data Storage files may be configured to "rollover" after they have become full. That is, after the space on the disk for each file type has run out, all of the oldest data on the disk is overwritten with the most recent data.

Initializing a ZIP disk

To activate the new data storage schedules that have been configured in the SET UP NEW SCHEDULES menu requires you to "initialize" the DOS formatted disk to which process and diagnostic data will be stored. This is done by executing a routine entitled INITIALIZE DISK, also found in the DATA STORAGE menu. This task can also be done on a PC. The task of initializing a disk and activating data storage schedules are one in the same.

ATTENTION

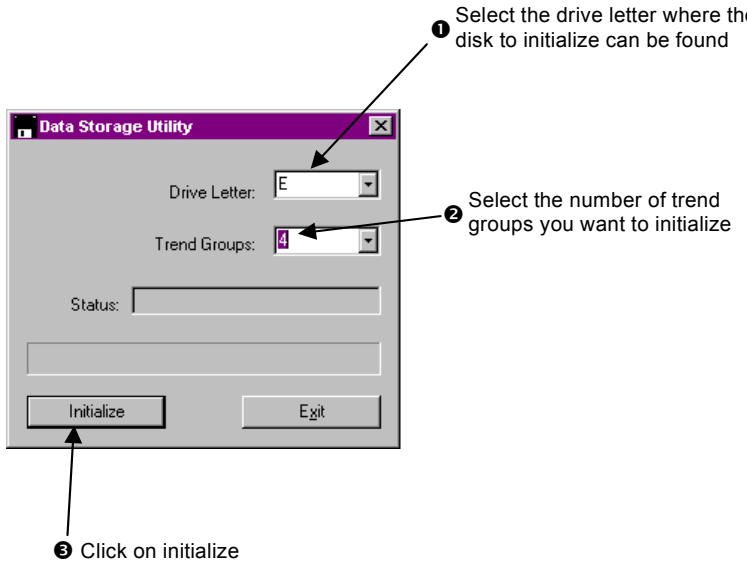
Initializing a disk is only necessary for performing Data Storage. You do not have to initialize a disk to perform Configuration, Set Point Program, or Calibration Storage

When executing the INITIALIZE DISK menu prompt, you will observe two selections: USE NEW SCHEDULES and USE CURRENT SCHEDULES. The "SCHEDULES" in both selections refer to the data storage schedules prepared in the SET UP NEW SCHEDULES menu described earlier. USE NEW SCHEDULES to initialize the disk to activate a newly configured data storage schedule for the very first time. The only time you will USE NEW SCHEDULES again is after you have made any changes to the way the data storage schedules have been configured. You must USE NEW SCHEDULES to initialize the disk in order for these changes to take effect. USE CURRENT SCHEDULES to initialize a disk if the disk will replace one that has become full. This will ensure that data being recorded continues uninterrupted over the space of both the full and replacement disks. During the time when the full disk is being replaced with a new disk, recorded data will be stored to the instrument's memory buffer. Upon completing initialization via the USE CURRENT SCHEDULES prompt, all buffered data will be written to the new disk and data storage will resume, with no lapses of storage between disks.

Disk initialization allocates sections of the disk to each of the files you have elected to store per the SET UP NEW SCHEDULES menu. Once the instrument completes initializing the disk, process and diagnostic data recording begins immediately, indicated by a yellow-colored letter "S" in the lower right hand corner of the instrument screen.

Pre-initializing a ZIPdisk on a PC

Pre-initializing a ZIP disk on the video recorder takes time, there is a more efficient way to do it : using theSDI tool. The SDI tool is a very basic, straightforward Win 95/98/NT program that can be used to quickly pre-initialize a ZIP disk on a PC. This tool is provided with the video recorder. Install it on your PC, as per instructions on the floppy disk label.
Here are the 3 steps to follow when running the SDI utility.



The next step to complete is to initialize the disk on the video recorder as you would have done normally, as explained in the «Initializing a zip disk» section, except that this time, it will take just a few seconds.

Note: it is recommended to dedicate a ZIP disk to storage of data only and store configurations of products on a separate disk.

Data Storage Status

The prompt DATA STORAGE STATUS, accessed from the Online DATA STORAGE menu item, displays a calculation of how long a particular disk will last based on the configured data storage schedule. Disk capacity is indicated in days, hours, and minutes remaining on the disk.

After the instrument has been Online and actively performing Data Storage to disk, a warning message will appear when the disk reaches the default 90% capacity, or a user-specified capacity. Once a disk has reached its programmed capacity, a DISK FULL message will be displayed.

Data storage considerations

In order to guarantee a proper operation of the instrument (e.g. no sample lost), there is a maximum load that the video recorder should not overcome. This load can be theorically computed by considering the number of data storage trends, live trends and live screens programmed and their associated sample rate.

1) One live screen counts for one schedule per second. At least one live screen is present in the instrument. A live screen is a display that require any measurement information to be built.

2) Each ENABLED Data Storage schedule has a user defined sample rate.

3) Each ENABLED Live Trend has the following sample rates :

Screen Size	Schedule Sample Rate
5 Min Screen	1 Second
15 Minute Screen	3 Seconds
30 Minute Screen	6 Seconds
1 Hour	12 Seconds
2 Hours	24 Seconds
4 Hours	47 Seconds
8 Hours	93 Seconds (1.55 Minutes)
24 Hours	279 Seconds (4.65 Minutes)
7 Days	1951 Seconds (32.5 Minutes)
31 Days	8640 Seconds (2.4 Hours)

Therefore, to guarantee a proper operation of the instrument, the following inequation should allways be true :

$$\sum \left[\frac{\text{Programmed trend (live or data storage)}}{\text{Associated sample rate}} \right] + \left[\text{Number of live screens} \right] < 6$$

EXAMPLES :

Example #1 : 4 Live Trends all having 1 Hour Screens + 1 Data Storage Trend at 5 Seconds + 1 Data Storage Trend at 10 Seconds + 1 Live Screen.

The result = ((1/12) * 4) + 1/5 + 1/10 + 1 = 1.6333 (BELOW THE LIMIT)

Example #2 : 1 Live Trends with 5 Minute Screen + 1 Data Storage Trend at 0.25 Seconds + 1 Live Screen.

The result = 1/1 + 1/0.25 + 1 = 6 (AT THE LIMIT)

Example #3 : 2 Live Trends with 5 Minute Screen + 1 Data Storage Trend at 0.25 Seconds + 1 Live Screen.

The result = (1/1 * 2) + 1/0.25 + 1 = 7 (ABOVE THE LIMIT)

Process and Diagnostic Data Integrity

The instrument is equipped with several features to ensure data integrity. The instrument will not store data to disk if its front door is open. A BEZEL OPEN message will appear on all displays and process and diagnostic data meant for disk storage will be kept in the instrument's memory buffer. Data corruption and loss are, therefore, not issues if someone walks up to the instrument and simply removes the Data Storage disk. Note that when performing Data Storage, the instrument writes to the disk only once a minute. This ensures that the latest data is always on disk. In the event of a power failure, at most one minute of data would be lost.

Performing Configuration Storage

Configuration storage is performed through a Program mode MAIN MENU prompt LOAD/STORE CONFIG. Here, a file containing the instrument's programming and configuration is created by executing a routine called STORE CONFIG TO DISK. The applicable file extensions for configuration files are .LNC.

Note that an instrument configuration file may also be created and stored to disk using optionally purchased SCF Configuration Software. You do not need a live instrument to create a configuration file using SCF.

Once stored to disk, the instrument configuration file may be downloaded into other instruments that have an identical model number. This helps to greatly reduce the amount of time required to program and configure multiple units sharing the same application. Having the instrument configuration on disk can also drastically minimize down time in the event of an instrument failure. The file can be used to program and configure a replacement unit within seconds.

Performing Set Point Program Storage

Refer to Section 5 of the manual for a detailed explanation of how Set Point Program Storage is accomplished.

4. How To Program Function Blocks and Features

4.1 Overview

This section describes all the programming procedures to get your instrument up and running, except Profiles which are discussed in Section 5. It describes the entire Program Mode menu and some items from the Online Mode menu.

What's in this section?

The following topics are covered in this section.

4.2 Programming tips

- See Section 3 for general programming procedures.
- Before programming a function block's input parameter with a CV's (Calculated Value) output parameter, you must program the CV first; otherwise, the CV's output parameter will not be available for programming.
- The function block SY (System Parameter) operates internally and has no menu. It automatically produces outputs which reflect the status of alarms, data storage, diagnostics, and reference junction temperature. These outputs can be programmed as inputs to function blocks. See Table 3-5 in Section 3.
- Each function block can be labeled with custom descriptors and tags to identify the function on displays. You can enter these labels under the menu item ENTER LABELS or within each function block's menu item. See Section 4.4 Frequently used programming prompts.
- All Program mode menu items and settings can be reviewed but not changed in the Online mode by selecting "REVIEW PROGRAMMING" on the main Online menu. See Enable Features, Section 4.19.
- We recommend you save the instrument configuration to a floppy disk after you have completed programming the instrument. See 4.23 Access LOAD/STORE CONFIG.

4.3 The Program mode menu

Program mode is an off-line mode for programming (configuring) the instrument. In this mode, all outputs are frozen.

Table 4-1 shows the top level of the Program Mode menu with all available options. Your instrument may have a reduced menu if options are not present or if features have been disabled.

Table 4-1 Program Mode Menu

Prompt	Function
SET MODE	Change operating mode of programmer
LABELS	Enter descriptive labels for parameters using instrument's buttons or a QWERTY keyboard or barcode reader.
ANALOG INPUTS	Program Analog Inputs.
CONTROL LOOPS	Program Control Loops.
ANALOG OUTPUTS	Program Analog Outputs.
DISCRETE INPUTS	Program Discrete Inputs.
DISCRETE OUTPUTS	Program Discrete Outputs.
CALCULATED VALUES	Program Calculated Values.
ALARMS	Program Alarms.
TOTALIZERS	Program Totalizers.
PROFILERS	Program Set point Profiles.
CONSTANTS	Program Constants.
DISPLAYS	Assign primary Online displays to the Display button.
FEATURES	Enable/disable certain menu items.
SECURITY	Enable/disable security on certain items.
SERIAL COMMUNICATIONS	Program Serial Communication.
COPY BLOCK	Copy any function block to another channel.
CLOCK	Set time and date.
LOAD/STORE CONFIG	Store and load configurations/calibrations.
SCAN RATE	Set scan rate of instrument.
LANGUAGE	Select language of instrument.

4.4 Frequently used programming prompts

When programming the instrument you will see certain prompts repeatedly in different menus. These are described in Table 4-2, rather than in each menu in which they appear.

Table 4-2 Frequently Used Programming Prompts

Prompt	Range/Selections	Definition
IN DECIMAL POS	X.XXXXX XX.XXXX XXX.XXX XXXX.XX XXXXX.X XXXXXX. X.XXEXX	Select the decimal point position to be used for all inputs to the function. Select X.XXEXX to display the function's values in exponential notation. Example: 1.23E4 means 1.23 x 10^4 .
OUT DECIMAL POS	Same as IN DECIMAL POS selections	Select the decimal point position that will be used for all outputs of the function.
ON LABEL*	OFF ON FILL DRAIN UP DOWN EMPTY FULL START STOP IN OUT LOW HIGH OPEN CLOSED RESET RUN HOLD ACTIVE TRUE FALSE READY ABORT LEFT RIGHT ALARM NORMAL DECRS INCRS AUTO MANUAL LOAD UNLOAD SP1 SP2 COOL HEAT NO YES PAUSE	Select the discrete function's ON(1) state label.
OFF LABEL*	Same as ON LABEL selections	Select the discrete function's OFF state label.
DESCR*	Enter up to 16 characters.	Usually appears as a header or title on some displays and reports. For alarms, this is the actual alarm message.
TAG*	Enter 7 characters maximum.	Identifies the point or function on most displays and reports. *Each tag must be unique.*
UNITS*	Default choices: PSI DEGR GAL MA BAR K LPH % MW MV LPM PH GPH V LPS KG GPM OHM LITR GRAM GPS HZ DEGC LB DEGF	Shows units of measure for analog values on most displays and reports. These 25 choices can be changed. See Table 4-4.
* Prompt does not appear if labeling is disabled under ENABLE FEATURES.		

4.5 Set Mode

Select this item to change the operating mode of the instrument to Online, Program or Maintenance. The top of the display will show which mode you have changed to.

Program mode

Program mode is an off-line mode for programming (configuring) the instrument. In this mode, all outputs are frozen.

Online mode

Online Mode enables full use of the instrument with its inputs, outputs and internal programming. In this mode, it is fully interactive with all externally connected elements.

Maintenance mode

Maintenance Mode is an off-line mode for maintaining proper and complete functioning of the instrument. Functions include calibration, off-line diagnostic testing, and various setups for operation. In Maintenance Mode, all outputs are frozen.

ATTENTION

Note: Changing to ONLINE mode by pressing any of the Display buttons can cause incorrect values to be displayed. The values will correct themselves in a few seconds. To avoid this potential annoyance, change to online mode through SET MODE instead of through the Display buttons.

4.6 Enter Labels

Overview

Labeling lets you use the front panel buttons, a QWERTY keyboard, or barcode reader to assign custom text identifiers to most data and functions to make them easily recognized on displays. Labeling items makes programming and operation easier but is not required. You can assign all labels here or at each individual programming menu (that is, at Program Analog Inputs, Program Alarms, etc.). For the latter, you must enable labeling under ENABLE FEATURES in the main Program menu.

Entering labels with the front panel buttons

Use the Up Arrow and Down Arrow keys to select a character and the left arrow to move the cursor. See Table 3-6 for these buttons' functions. If you are entering several labels, this method can be tedious because you must scroll through A-Z and 0-9 to pick each character. Consider using a keyboard or barcode reader instead.

Entering labels with a QWERTY keyboard

Using a QWERTY keyboard is easier and faster if you are entering many labels. See Section 3.6 for keyboard connection procedure.

To enter label with the keyboard:

1. Select Enter Labels.
2. Select the function block whose label you want to change.
3. Select the label you want to change (Table 4-3).
4. Press Enter to move cursor to the right side of the display.
5. Type in the new label with the keyboard. The instrument accepts A…Z, a…z, 0…9, (,), -, +, /, *, ^, (.), =.
6. Press Enter to accept the new label.

Entering labels with a barcode reader

Using a barcode reader is easier and faster if you are entering many labels. See Section 3.6 for barcode reader connection procedure.

To enter label with the barcode reader:

1. Select Enter Labels.
2. Select the function block whose label you want to change.
3. Select the label you want to change (Table 4-3).
4. Press Enter to move cursor to the right side of the display.
5. Scan in the new label with the barcode reader. Allowable characters are: 0…9, A…Z, -, +, /,
6. Press Enter to accept the new label.

After selecting ENTER LABELS, choose an item (such as Analog Inputs) to label. Use the prompts in Table 4-3. All text and numeric keys may be used for labels; no characters are prohibited. To cancel an entry, press the ESC key on the keyboard or press the Menu button on the front panel.

Table 4-3 Labels for Function Blocks

Prompt	Range/Selections	Definition
DESCR	Enter 16 characters maximum.	Called a *descriptor*. Usually appears as a header or title on some displays and reports. For alarms, this is the actual alarm message. If labeling is enabled, the descriptor can be edited in the function block's program menu.
TAG	Enter 7 characters maximum.	Identifies the point or function on most displays and reports. *Each tag must be unique.* If labeling is enabled, the tag can be edited in the function block's program menu.
UNITS	Default choices: PSI DEGR GAL MA BAR K LPH % MW MV LPM PH GPH V LPS KG GPM OHM LITR GRAM GPS HZ DEGC LB DEGF	Shows units of measure for analog values on most displays and reports. This list of units can be changed under the ENGINEERING UNITS menu item. If labeling is enabled, the units can be edited in the function block's program menu.
ON STATE	OFF ON FILL DRAIN UP DOWN EMPTY FULL START STOP IN OUT LOW HIGH OPEN CLOSED RESET RUN HOLD ACTIVE TRUE FALSE READY ABORT LEFT RIGHT ALARM NORMAL DECRS INCRS AUTO MANUAL LOAD UNLOAD SP1 SP2 COOL HEAT NO YES PAUSE	Select a label describing the ON(1) state of the discrete function. These labels cannot be changed.
OFF STATE	See ON STATE for default choices.	Select a label to describe the OFF (0) state of the discrete function. These labels cannot be changed.

Table 4-4 Other Labels

Prompt	Range/Selections	Definition
UNIT	Enter up to 16 characters to specify a label for the instrument.	The unit name appears on all Data Storage floppy disks coming from this instrument.
ENGINEERING UNITS	Enter up to 4 characters to change available engineering units from the defaults: PSI DEGR GAL MA BAR K LPH % MW MV LPM PH GPH V LPS KG GPM OHM LITR GRAM GPS HZ DEGC LB DEGF	You can change the 25 engineering units available in Table 4-3 as UNITS. To reset the 25 engineering units to their defaults, select RESET DEFAULTS.
FILENAMES	Enter up to 6 characters to change available filenames from these defaults: FILE CYCLE DRYER PROD RECORD TANK UNIT LOOP REACTR CONFIG KILN VESSEL CALIB WCHEM PRESS FURNCE DEMIN CONTRL BATCH FERMTR LEHR LINE STRLZR OVEN ZONE	These filenames will appear as choices on other menus. To reset the filenames to their defaults, select RESET DEFAULTS.

4.7 Program Analog Inputs

To program Analog Inputs, select PROGRAM ANALOG INPUTS on the Main Program Menu. Select an AI to program.

Table 4-5 Analog Input Algorithm Selection

Prompt	Range/Selections	Definition
INPUT ALGORITHM	Standard or Custom	This prompt appears only if "CUSTOM INPUT" is enabled under Enable Features in the Program Mode Menu (Section 0). If "CUSTOM INPUT" is disabled you will see the Standard prompts (Table 4-6). Standard lets you choose a thermocouple, RTD, EMF, or pyrometer type. The Standard prompts are shown in Table 4-6. Custom lets you convert the input from a thermocouple or EMF to engineering units using a custom curve containing up to 20 points.

Standard algorithm prompts

Table 4-6 describes all the prompts associated with the standard algorithm. These are the default prompts for analog input programming. See Table 4-2 for additional prompts.

Table 4-6 Standard Algorithm Prompts

Prompt	Range/Selections	Definition
INPUT TYPE	See Table 1-3 for selections. The default type is OFF.	Input type (thermocouple, RTD, pyrometer)
RANGE LOW	The value must be within the limits specified for the input type (see Table 1-3). Be sure to use the correct value for the temperature units used (°F, °C, K, °R). To enter the full range for the temperature units selected (see TEMPERATURE UNITS), select TYPE again and press Enter without changing the range type.	Low end of the input range.
RANGE HIGH	The value must be within the limits specified for the input type (see Table 1-3). Be sure to use the correct value for the temperature units used (°F, °C, K, °R). To enter the full range for the temperature units selected (see TEMPERATURE UNITS), select TYPE again and press Enter without changing the range type.	High end of the input range.

Table 4-6 Standard Algorithm Prompts (continued)

Prompt	Range/Selections	Definition
TEMPERATURE UNIT	Select C for Degrees Celsius, F for Degrees Fahrenheit, K for Kelvin, R for Rankine, or NONE.	Specifies the temperature units used for thermocouple, pyrometer, and RTD input types. The default setting is F. If you change the default, be sure to change the analog input's RANGE LOW and RANGE HIGH values accordingly. The instrument will not adjust these values by itself. Ignore the TEMPERATURE UNIT prompt or set it to NONE, if the analog input being programmed will not be used for temperature measurements.
DIRECT/INDIRECT	Select DIRECT for thermocouple, pyrometer, or RTD inputs. Select INDIR (Indirect) for volt or millivolt signal inputs from linear or non-linear transmitters. Select SQRT (Square Root) for extracting flow measurements from a voltage input representing differential pressure measurements. If SQRT is chosen, the RANGE LOW and RANGE HIGH must be adjusted to specify the upper and lower limits of the flow units span.	Note that the term "direct" generally applies to input types where the sensors in direct physical contact with the monitored process are also in direct physical contact with the instrument terminal board. The term "indirect" applies to inputs from transmitters since the sensors in direct physical contact with the monitored process are indirectly connected to the instrument through the transmitter circuitry and wiring.
CIRCUIT LOW	OFF or number	Appears only if "INDIR" or "SQRT" was previously selected. Is the actual low end value of voltage to be used for Indirect measurements.
CIRCUIT HIGH	OFF or number	Appears only if "INDIR" or "SQRT" was previously selected. Is the actual high end value of voltage to be used for Indirect measurements.
ELECTRICAL UNITS	Select whether the CIRCUIT LOW or CIRCUIT HIGH values specified are in units of VOLTS, MV (millivolts), or OHMS.	Circuit low and circuit high units.
LAG	≥ 0 seconds or OFF	"LAG" is a time constant applied to the input measurement value. This provides digital filtering (LAG) to the measurement. Lag appears on menu only if EXPANDED INPUT is enabled under Enable Features in the Program menu.
SAMPLE HOLD	OFF, discrete parameter, 0, 1	Holds Input. The input value is measured normally when this discrete is OFF and holds its last value when the discrete is ON(1). Hold appears on menu only if EXPANDED INPUT is enabled under Enable Features in the Program menu.
FAILSAFE	For thermocouples only, Upscale (UP), Downscale (DOWN) or None.	Determines whether or not failsafe is active and, if so, which direction.
CLAMPING	HI RANGE clamps the input at the RANGE HIGH value. LO RANGE clamps input at the RANGE LOW value. RANGE clamps input over both the low and high range values. NONE gives no clamping.	Clamps input at specified value. ***ATTENTION***: Clamping is not recommended for process variable inputs to control loops.

Custom algorithm prompts

Table 4-7 describes the custom algorithm prompts. See Table 4-2 for additional prompts. These prompts appear only if CUSTOM INPUT is enabled under FEATURES. See Section 0.

Table 4-7 Custom Algorithm Prompts

Prompt	Range/Selections	Definition
INPUT SIGNAL	EMF, TC, or RTD.	Selects the input hardware.
RJ ENABLE	Select YES for reference junction compensation, NO for no compensation.	Reference junction compensation.
EMISSIVITY ENABLE	Select YES for emissivity compensation for emf input.	Emissivity compensation for emf input.
Xn	You must input at least 2 coordinates. X must increase by at least 0.00001. Y values are not limited except in the following 2 cases. 1. If the incoming signal is from a thermocouple and reference junction compensation is on, make sure that a, b, and c are all true. a) All Y's are increasing or all are decreasing. b) Y range includes 0-65°C. c) Temperature units are °F, °C, K, or °R. 2. If Online adjustment of the value is desired, make sure that all Y's are increasing or all are decreasing.	Use these prompts to plot a curve of up to 20 points, where X_n is the incoming signal in the electrical units selected and Y_n is its corresponding value in the temperature units selected. Interpolation is straight-line.
Yn		
ELECTRICAL UNITS	MV, OHMS, VOLTS	Units of the electrical signal.
LAG	≥ 0 seconds or OFF	LAG is a time constant applied to the input measurement value. This provides digital filtering (LAG) to the measurement. Lag appears on menu only if EXPANDED INPUT is enabled under Enable Features in the Program menu.
SAMPLE HOLD	OFF, discrete parameter, 0, 1	Holds Input. The input value is measured normally when this discrete is OFF(0) and holds its last value when the discrete is ON(1). Hold appears on menu only if EXPANDED INPUT is enabled under Enable Features in the Program menu.

Press Menu when entries are complete. At the prompt "PRESS ENTER TO SAVE", press Enter to save your changes, or press Menu again to exit the session without saving the changes.

4.8 Program Control Loops

Control Loop Programming Structure

Programming a control loop requires configuring at least 3 function blocks: an Analog Input (AI), a loop algorithm and an Analog Output (AO). The term AO is applied to any type of control output; current (CAT), or time proportioning (DAT). The structure of the instrument permits many variations on this concept by allowing Calculated Values (CVs), both digital and analog, to be used as inputs to the different parameters within the control algorithms. It also allows a single parameter to be read by any number of function blocks in the unit.

Loop Characteristics

Table 4-8 lists loop characteristics to be aware of when configuring your instrument.

Table 4-8 Loop Characteristics

Characteristic	What to be aware of
Choice of algorithm type	Two PID algorithm types, interactive and noninteractive. Noninteractive is the default type; however, this may be changed.
Gain or proportional band	PB is the default; however this may be changed.
7 loop types available	If the loop type is changed after a configuration is completed, all previously programmed entries will be deleted.
Diagnostic routines	You will be prompted to save your entries when leaving the loop program sequence. Diagnostic routines are executed at this time to verify all entries are complete and compatible. A FAIL message at this time may indicate incomplete entries or incompatible selections.
Split output tuning	When programming Split Output control loops, tuning parameter set #1 is automatically applied to output values between 0 and +100. Tuning parameter set #2 is automatically applied to output values between 0 and -100.
Programming loop parameters	Control loop programming may require entry of numerical values, analog parameters or discrete parameters as determined by the specific loop feature. In some cases the choices may be a numeral, an analog parameter or OFF. For parameter choices, refer to Table 3-2 for definitions of the discrete and analog parameter types available. OFF or NONE are listed as menu choices where applicable. Scroll to locate.
Minimum programming requirements	Many of the prompted entry fields for control loops are optional. As a general rule, the minimum entry information for control loops includes the Process Variable (PV) with range limits, set point value, some combination of gain, reset and rate, and a source for the feedback. In most cases, the feedback source will be the back-calculation output (BC) value of the analog output (AO) function block.

Table 4-8 Loop Characteristics (continued)

Characteristic	What to be aware of
Split output programming requirements	A splitter output type (Standard or Advanced) calculated value is used to send the Split loop output to 2 or 3 different analog output (AO) functions. In this case, program the control loop to receive a feedback from the back calculation output of the splitter calculated value. In other words, loop Feedback = CVn BC (where CVn is a Splitter type calculated value and BC is its output). Program the splitter calculated value to accept the back-calculation values (BC) of each analog output function block (AO) as its feedback source. In other words, CVn FB = AOn BC.
Cascade primary loop	Be sure to scale the cascade primary loop's output limits to match the process variable range of the secondary control loop. (Note: Output scaling is only available on the cascade primary type of control loop.) The primary loop feedback should be connected to the back calculation value of the secondary control loop.
Miscellaneous loop characteristics	Other parameters affecting loops are latching and reset limit. These are described in the loop prompt table.

Programming Procedure

To program Control Loops, select "PROGRAM CONTROL LOOPS" in the Main Program Menu. Select a loop to program.

Table 4-9 illustrates the menu selections for the various loop types. See Table 4-10 for an alphabetical listing of these parameters' descriptions. Enter all desired choices, then repeat the procedure, if desired, for the other Loops.

Table 4-9 Control Loop Type Menu Selections

STD	ADV	SPLIT	ON OFF	CAS P	CAS S	RATIO	DIAT
IN DECIMAL POS	IN DECIMAL POS	IN DECIMAL POS	IN DECIMAL POS	IN DECIMAL POS	IN DECIMAL POS	IN DECIMAL POS	IN DECIMAL POS
OUT DECIMAL POS	OUT DECIMAL POS	OUT DECIMAL POS	OUT DECIMAL POS	OUT DECIMAL POS	OUT DECIMAL POS	OUT DECIMAL POS	OUT DECIMAL POS
PV	PV	PV	PV	OUT UNITS	PV	PV	PV
PV HIGH LIMIT	PV HIGH LIMIT	PV HIGH LIMIT	PV HIGH LIMIT	PV	PV HIGH LIMIT	PV HIGH LIMIT	PV HIGH LIMIT
PV LOW LIMIT	PV LOW LIMIT	PV LOW LIMIT	PV LOW LIMIT	PV HIGH LIMIT	PV LOW LIMIT	PV LOW LIMIT	PV LOW LIMIT
CONTROL ACTION	CONTROL ACTION	CONTROL ACTION	CONTROL ACTION	PV LOW LIMIT	CONTROL ACTION	CONTROL ACTION	CONTROL ACTION
GAIN/PROP BAND	GAIN/PROP BAND	GAIN/PROP BAND	SP1 TRACKING	CONTROL ACTION	GAIN/PROP BAND	GAIN/PROP BAND	GAIN/PROP BAND
PROP BAND#1/GAIN#1	PROP BAND#1/GAIN#1	PROP BAND#1/GAIN#1	SETPOINT#1	GAIN/PROP BAND	PROP BAND#1/GAIN#1	PROP BAND#1/GAIN#1	PROP BAND#1/GAIN#1
RESET#1	RESET#1	RESET#1	SETPOINT#2	PROP BAND#1/GAIN#1	RESET#1	RESET#1	RESET#1
RATE#1	RATE#1	RATE#1	SP INC SLEW LIMIT	RESET#1	RATE#1	RATE#1	RATE#1
PROP BAND#2/GAIN#2	PROP BAND#2/GAIN#2	PROP BAND#2/GAIN#2	SP DEC SLEW LIMIT	RATE#1	PROP BAND#2/GAIN#2	PROP BAND#2/GAIN#2	PROP BAND#2/GAIN#2
RESET#2	RESET#2	RESET#2	SP HIGH LIMIT	PROP BAND#2/GAIN#2	RESET#2	RESET#2	RESET#2
RATE#2	RATE#2	RATE#2	SP LOW LIMIT	RESET#2	RATE#2	RATE#2	RATE#2
MANUAL RESET	MANUAL RESET	MANUAL RESET	PV TRACKING	RATE#2	MANUAL RESET	MANUAL RESET	MANUAL RESET
SP1 TRACKING	APPROACH HIGH	APPROACH HIGH	HYSTERESIS	MANUAL RESET	SETPOINT#1	APPROACH HIGH	APPROACH HIGH
SETPOINT#1	APPROACH LOW	APPROACH LOW	MANUAL OFF	SP1 TRACKING	SETPOINT#2	APPROACH LOW	APPROACH LOW
SETPOINT#2	SP1 TRACKING	SP1 TRACKING	INTERACTIVE	SETPOINT#1	SP INC SLEW LIMIT	SP1 TRACKING	SP1 TRACKING
SP HIGH LIMIT	SETPOINT#1	SETPOINT #1	RESET LIMIT	SETPOINT#2	SP DEC SLEW LIMIT	SETPOINT #1	SETPOINT#1
SP LOW LIMIT	SETPOINT#2	SETPOINT #2	LATCHING	SP INC SLEW LIMIT	SP HIGH LIMIT	SP INC SLEW LIMIT	SETPOINT#2
SUPPRESS OVERSHOOT	SP INC SLEW LIMIT	SP INC SLEW LIMIT		SP DEC SLEW LIMIT	SP LOW LIMIT	SP DEC SLEW LIMIT	SP INC SLEW LIMIT
PV TRACKING	SP DEC SLEW LIMIT	SP DEC SLEW LIMIT		SP HIGH LIMIT	SOFT PID	SP HIGH LIMIT	SP DEC SLEW LIMIT
FEEDBACK	SP HIGH LIMIT	SP HIGH LIMIT		SP LOW LIMIT	FEEDBACK	SP LOW LIMIT	SP HIGH LIMIT
INTERACTIVE	SP LOW LIMIT	SP LOW LIMIT		SUPPRESS OVERSHOOT	FEEDFORWARD	RATIO SETPOINT	SP LOW LIMIT
RESET LIMIT	SUPPRESS OVERSHOOT	SUPPRESS OVERSHOOT		SOFT PID	FEEDFORWARD GAIN	RATIO BIAS	SUPPRESS OVERSHOOT
LATCHING	PV TRACKING	PV TRACKING		FEEDBACK	OUTPUT TRACKING	WILD VARIABLE	PV TRACKING
	SOFT PID	SOFT PID		FEEDFORWARD	FORCE REMOTE MAN	PV TRACKING	SOFT PID
	FEEDBACK	FEEDBACK					FEEDBACK

(continued)

Table 4-9 Control Loop Type Menu Selections (continued)

STD	ADV	SPLIT	ON OFF	CAS P	CAS S	RATIO	DIAT
	FEEDFORWARD	FEEDFORWARD		FEEDFORWARD GAIN	CHG ACTION INPUT	SOFT PID	FEEDFORWARD
	FEEDFORWARD GAIN	FEEDFORWARD GAIN		CHG ACTION INPUT	DUAL TUNING SEL	FEEDBACK	FEEDFORWARD GAIN
	OUTPUT TRACKING	OUTPUT TRACKING		DUAL TUNING SEL	DISCR VS KEY SEL	FEEDFORWARD	OUTPUT TRACKING
	FORCE REMOTE MAN	FORCE REMOTE MAN		DISCR VS KEY SEL	SETPOINT SELECT	FEEDFORWARD GAIN	FORCE REMOTE MAN
	CHG ACTION INPUT	CHG ACTION INPUT		SETPOINT SELECT	AUTO/MAN SELECT	OUTPUT TRACKING	CHG ACTION INPUT
	DUAL TUNING SEL	DUAL TUNING SEL		AUTO/MAN SELECT	INTERACTIVE	FORCE REMOTE MAN	DUAL TUNING SEL
	DISCR VS KEY SEL	DISCR VS KEY SEL		OUTPUT LOW LIMIT	RESET LIMIT	CHG ACTION INPUT	DISCR VS KEY SEL
	SETPOINT SELECT	SETPOINT SELECT		OUTPUT HIGH LIMIT	LATCHING	DUAL TUNING SEL	SETPOINT SELECT
	AUTO/MAN SELECT	AUTO/MAN SELECT		INTERACTIVE		DISCR VS KEY SEL	AUTO/MAN SELECT
	INTERACTIVE	INTERACTIVE		RESET LIMIT		SETPOINT SELECT	INTERACTIVE
	RESET LIMIT	RESET LIMIT		LATCHING		AUTO/MAN SELECT	RESET LIMIT
	LATCHING	LATCHING				INTERACTIVE	LATCHING
						RESET LIMIT	
						LATCHING	

Loop Menu Items

Table 4-10 alphabetically describes every loop menu item. See Table 4-2 for additional prompts.

Table 4-10 Loop Prompts

Prompt	Range/Selections	Definition
APPROACH HIGH	Enter a value 0.1 to 100 or OFF.	This function affects the process variable approach to set point when the process variable value is less than the set point value. The value entered is the percent of span deviation from set point at which a recalculation of the loop integral value will occur. Enter a starting value equal to the proportional band value (1/gain value) x 100 if Gain is used, or OFF at initial configuration. The value may be altered Online for final loop tuning. This function is useful for batch startup from a "cold" condition to control excessive overshoot when set point is reached.
APPROACH LOW	Enter a value 0.1 to 100 or OFF.	Affects the process variable approach to set point when the process variable value is greater than the set point value.
AUTO/MAN SELECT	OFF, discrete parameter, 0, 1	This parameter takes the place of the Auto/Man button when the DISCR VS KEY SEL discrete is ON (1). AUTO/MAN SELECT = ON(1) = Manual mode AUTO/MAN SELECT = OFF (0) = Automatic mode When DISCR VS KEY SEL is OFF(0), AUTO/MAN SEL has no effect.
CHG ACTION INPUT	OFF, discrete parameter, 0, 1	Change Action Input. Selects the opposite control action from that selected for the control action (see CONTROL ACTION). Control action is opposite when the discrete value is ON or "1".
CONTROL ACTION	Reverse (REV) or Direct (DIR) Acting Control.	When Reverse Acting Control is selected, the loop output will increase as the process variable becomes less than set point, and will decrease as it becomes greater than the set point. When Direct Acting Control is selected, the output action is opposite.
DISCR VS KEY SEL	OFF, discrete parameter, 0, 1	Discrete vs. Keyboard select. When this discrete is ON (1), the Auto/Man and Set point buttons are disabled; their functioning is transferred to the AUTO/MAN SELECT and SETPOINT SELECT discretes. See AUTO/MAN SELECT and SETPOINT SELECT. Status changes made by AUTO/MAN SELECT and SETPOINT SELECT will remain when DISCR VS KEY SEL is OFF (0).
DUAL TUNING SEL	OFF, discrete parameter, 0, 1	When ON(1), selects the second set of tuning constants (#2). A bumpless transfer (integral term adjusted) calculation will be made on transition.

Table 4-10 Loop Prompts (continued)

Prompt	Range/Selections	Definition
ENGINEERING UNITS	Select letter	Units of measure for values of process variable or set point which will appear on Online loop displays.
FEEDBACK	OFF, analog parameter, number	Provides verification to the loop that the loop output request (LP OV) was achieved by the analog output module (AO). Feedback sources are typically pointed to the associated Back Calculation Value (BC) of an analog output module. Feedback inputs must have a span equal to the loop output span when they are not pointed directly to analog output modules.
FEEDFORWARD	OFF, analog parameter, number	Modifies the control loop output independent of the PID calculation. The range of the value should not exceed 0 to 100 units. Feedforward is typically used to provide an output change in anticipation of a change to the loop process variable.
FEEDFORWARD GAIN	-10.00 to 10.00	Applies gain to the feedforward input value.
FORCE REMOTE MAN	OFF, discrete parameter, 0, 1	When discrete is ON(1), forces loop from automatic mode to remote manual mode. In remote manual, loop output is determined by the OUTPUT TRACKING value and the local Down Arrow and Up Arrow buttons for manual output adjustment are disabled. In remote manual the automatic indicator (AUTO) of the display will flash. Selecting Manual mode from the Auto/Manual button will override remote manual operation. When the loop's Set point #2 is programmed as the Set point Profiler (SPn OV), Force Remote manual should be programmed as OFF.
GAIN/PROP BAND	PB or GAIN	Select whether gain or proportional band will be used for tuning the control loop.
GAIN#1 OR GAIN#2	Enter a value of 0.1 to 200 for Gain, or 0.5 to 1000.0 for Proportional Band. Enter OFF to allow integral only control. (Variable Gain1 or PB1 is available by programming a constant's Destination with GN or PB. See Program Constants, Section 4.16.)	Gain is the proportional gain entry for the control loop (The value entered here is the gain applied to the error signal to determine the loop output). For example, a 10% change in process variable (with respect to the input range) from a balanced condition will result in a 10% change in output, when a gain of 1.0 is used. Enter a starting value at initial configuration. The value may be altered Online for final loop tuning. If an indirect source is specified as in an adaptive gain configuration, the value can only be altered at the source. Gain and Proportional Band are interchangeable values (Proportional Band = 100/Gain). For loops with dual tuning, Gain 1 is the gain for the first set of tuning parameters. Gain 2 is for the second set.
HYSTERESIS	Enter 0-100% of PV span	Deadband value prevents excessive output oscillation when using ON/OFF control.

Table 4-10 Loop Prompts (continued)

Prompt	Range/Selections	Definition
IN DECIMAL POSITION	Select decimal position	Used for all input parameters of the loop.
INTERACTIVE	YES, NO	Select interactive (YES) or noninteractive (NO) for the control algorithm operation. Interactive causes the Gain, Rate, and Reset terms to interact to make up the proportional term of the algorithm (similar to analog controllers). In noninteractive the proportional term is simply related to Gain.
LATCHING	YES, NO	Select the desired action required after a failure to the failsafe status. When the loop's PV or Set point #2 fails, the downstream function block activates its failsafe (See Table 9-3, Default condition column). If latching = YES, when the failure is corrected the operator must take specific action to cancel these failsafe measures and return the loop to normal operation. (See Table 9-3 for action needed.) If latching = NO, when the failure is corrected the loop will automatically return to normal operation with no action needed by the operator.
MANUAL OFF	OFF, discrete parameter, 0, 1	When this discrete input goes ON (1) it causes the control output to go off.
MANUAL RESET	-100 to +100	This feature functions only when OFF is entered for RESET. Enter a value equal to the desired loop output when the process variable is at set point. This allows correction of output to account for load changes to bring the process variable up to set point.
OUTPUT LOW LIM & OUTPUT HIGH LIM	OFF or number	For cascade primary loop, set to PV LOW LIMIT and PV HIGH LIMIT of the cascade secondary loop, respectively.
OUTPUT TRACKING	0-100%, Analog parameter, OFF	This will be the loop's output value when the FORCE REMOTE MAN input to the loop is high (1). See Force Remote Man.
PROCESS VARIABLE	OFF, analog parameter, number	Process variable for the loop.
PROP BAND#1 & PROP BAND#2		See GAIN#1 OR GAIN#2
PV LOW LIMIT & PV HIGH LIMIT	OFF or number	Enter the high and low limits for the process variable being controlled. Loop tuning parameters are based on the span selected by the high and low limit values.
PV TRACKING	PV, OFF	A selection of Process Variable (PV) will cause Set point #1 of the control loop to track the process variable when the loop is in Manual mode. A transfer to Automatic mode will maintain the tracked set point value as the working set point of the loop unless the loop was operating from Set point 2 prior to the transfer to Manual.

Table 4-10 Loop Prompts (continued)

Prompt	Range/Selections	Definition
RATE#1 & RATE#2	0.02-10.00 minutes	Modifies the loop output based on the rate of change of the process variable. The output is modified by a value that assumes the rate of change of the process variable will continue for the time period specified. Enter a starting value or OFF at the time of configuration. The value may be altered Online for final loop tuning. For loops with dual tuning, Rate 1 is the rate for the first set of tuning parameters. Rate 2 is for the second set. (Variable Rate1 is available by programming a constant's Destination with RT. Program Constants, Section 4.16.)
RESET#1 & RESET#2	0.005-99.99 repeats/minute	Determines the period of time for a repeat of the proportional gain output. Enter a starting value at initial configuration. The value may be altered Online for final loop tuning. For loops with dual tuning, Reset 1 is the time for the first set of tuning parameters. Reset 2 is for the second set. (Variable Reset1 is available by programming a constant's Destination with RS. See Program Constants, Section 4.16.) A value of OFF may be entered to allow proportional-only control. When turned off, the manual reset value determines the loop output at set point. Bumpless manual to automatic transfer is canceled when proportional only control is selected.
RESET LIMIT	OFF or 100 to 200%.	This value restricts the calculated integral value of the loop during Cold Start or on a manual-to-automatic transfer.
RATIO BIAS		Enter a bias value to be used in calculating the working set point of the ratio control loop. This is essentially a value that will be added to the product that results when RATIO SETPOINT is multiplied by the ratio loop's wild variable input value. For example, in the fuel-air ratio control scenario introduced in the RATIO SETPOINT section, suppose fuel flow is the wild variable that measured to be 60. With the RATIO SETPOINT prompt set to 0.5, the result will be 30 when the RATIO SETPOINT is multiplied by the fuel flow. If the RATIO BIAS prompt is then set to 10, the actual set point that the ratio loop will use to control air flow will be 30 + 10 = 40. To make a ratio control loop's working set point equal to: (RATIO SETPOINT x Wild Variable value) + RATIO BIAS the loop's working set point must be toggled to SP2 using the "SP (Set Point select)" key while viewing the loop's ON LINE display. Refer to Figure 4-1.

Table 4-10 Loop Prompts (continued)

Prompt	Range/Selections	Definition
RATIO SETPOINT		Enter a number will equal the ratio that the ratio control loop will maintain between its process variable and a "wild variable." The wild variable may be the Output Value of any analog input or calculated value function block over which the ration loop will have no control. The RATIO SETPOINT menu choice is essentially a multiplier applied to the wild variable's value. This multiplication's result will be a working set point for the loop that will ensure the desired "process variable-to-wild variable" ratio. For example, suppose you intend to use the ratio control loop to maintain a 50% fuel-air ratio in the operation of a furnace. If the loop will be directly controlling air flow (i.e. - air flow will be the loop's process variable) and fuel flow will be used as a wild variable to generate the ratio loop's working set point, the RATIO SETPOINT menu choice will have to be set to 0.50. Hence, if fuel flow is measured to be 60, the working set point that will be used in the ratio loop's control of air flow will be (60) x (0.50) = 30. To make a ratio control loop's working set point equal to the product of RATIO SETPOINT and a specific wild variable value, the loop's working set point must be toggled to SP2 using the "SP (Set Point Select)" key while viewing the loop's ON LINE display. Refer to Figure 4-1.
SETPOINT SELECT	OFF, discrete parameter, 0, 1	When the DISCR VS KEY SEL discrete is ON (1) this parameter takes the place of the On-Line Tune Loop menu's Toggle Set point Source prompt. SETPOINT SELECT = ON (1) = Set point2 SETPOINT SELECT = OFF (0) = Set point1 When DISCR VS KEY SEL is OFF(0), SETPOINT SELECT has no effect.
SETPOINT#1 & SETPOINT#2	Set point #1 can be a number only. Set point #2 can be a number, an analog parameter, or OFF.	Set point #1 and #2 are independent set points. Either may be the active set point for the loop. When viewing a live ON LINE mode control loop display, a loop may be switched between SETPOINT #1 and SETPOINT #2 by accessing the Tune Loop menu and selecting TOGGLE SETPOINT SOURCE. Operation of the loop using SETPOINT #1 will be indicated by the presence of an "SP1" symbol on the loop's display. "SP2" will be the symbol observed when the loop is operating using SETPOINT #2. While SETPOINT #2 may be programmed as a numerical value, it may also be used as a remote set point input to the loop. You may link SETPOINT #2 to any of several analog parameters that include the Output Values of analog input or calculated value function blocks. If used as a remote set point input, SETPOINT #2's value may not be manually changed from within any live ON LINE mode control loop displays.
SOFT PID	YES, NO	Soft PID action (YES) causes the control algorithm to not calculate proportional output corresponding to errors resulting from changes to set point. The algorithm will adjust its Reset (Integral) term to a value required to maintain the present output when the set point is changed. Normal proportional action should occur for all changes and variations to the controlled variable.

Table 4-10 Loop Prompts (continued)

Prompt	Range/Selections	Definition
SP INC SLEW LIMIT & SP DEC SLEW LIMIT	Enter a number	Working set point slew limits for increasing and decreasing slew rates. (Variable slew limits are available by programming a constant's Destination with IS or DS. See Program Constants, Section 4.16.)
SP LOW LIMIT & SP HIGH LIMIT	OFF or number	Limits will be imposed on the working set point value, regardless of source. A set point value above or below the limits will be entered into the loop at the limit value. OFF entry will assume process variable limits. (Variable limits are available by programming a constant's Destination with HS or LS. See Program Constants, Section 4.16.)
SP1 TRACKING	SP2, NONE	A selection of Set point #2 will cause the Set point #1 value to be set to the Set point #2 value on a transfer from Set point #2 to Set point #1. Set point #1 adjustment may be made after the transfer.
SUPPRESS OVERSHOOT	YES, NO	This parameter set to YES limits overshoot of the Set point (SP) by the Process Variable (PV) after a disturbance in the process such as a load or SP change. Through fuzzy logic, the working SP of the control loop is dynamically modified by the control algorithm to reduce or eliminate overshoot.
ATTENTION Regardless of the setting of this SUPPRESS OVERSHOOT selection, overshoot is not suppressed when the process disturbance causes an initial deviation (PV-SP) value between -0.7 and +0.7 engineering units. Consequently, overshoot may not be suppressed in applications which require numerically small control loop PV ranges such as carbon potential where this range is typically 0.0 to 2.0 engineering units.		
WILD VARIABLE		Enter an analog input (AIn OV) or calculated value (CVn OV) parameter that represents a second input signal applied to the ratio control loop whose value will be multiplied by the RATIO SETPOINT multiplier. The product of this multiplication may be specified as the ratio control loop's working set point and can be biased by specifying a RATIO BIAS value. This input parameter is referred to as the "WILD VARIABLE" since the ratio loop has no control over its value whatsoever. In the fuel-air ratio control examples used in RATIO SETPOINT AND RATIO BIAS, fuel flow was for all intents and purposes the WILD VARIABLE. Note that the typical function block diagram one will use to represent a ratio control loop is illustrated in Figure 4-1.

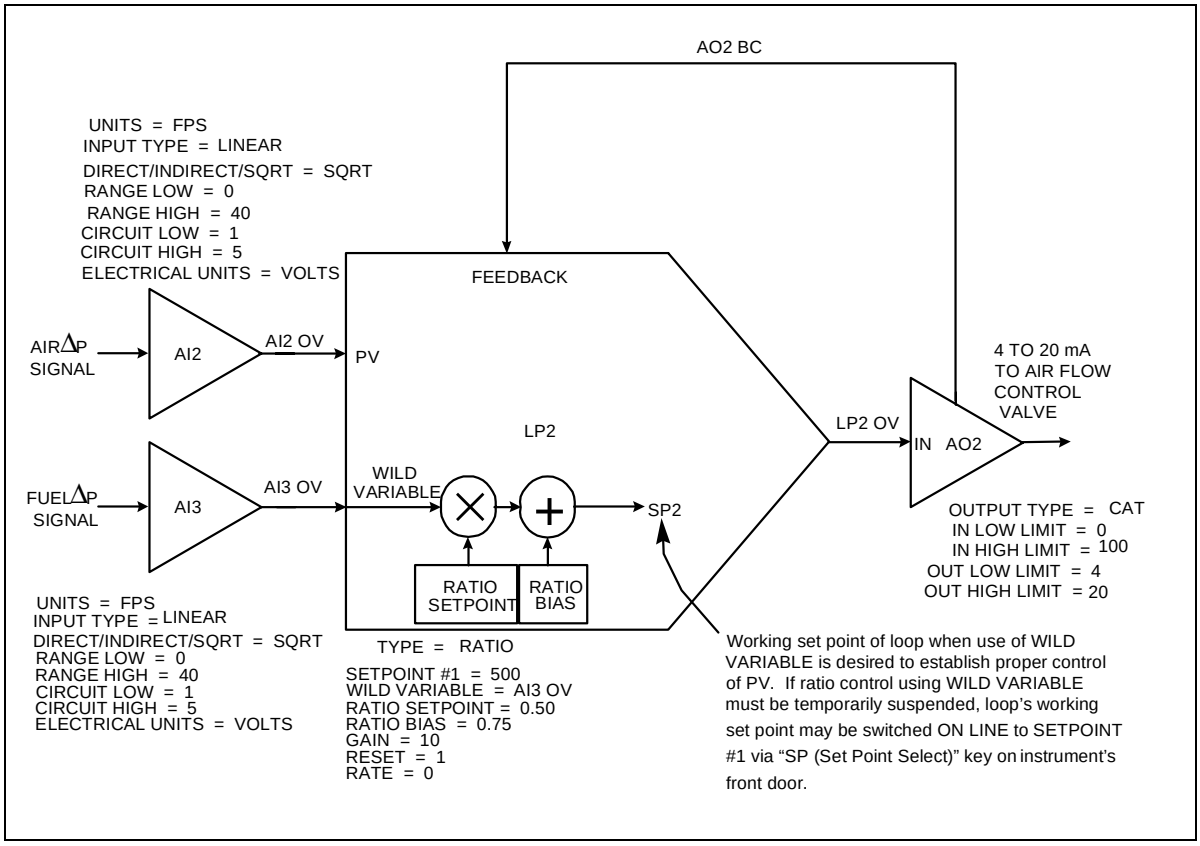


Figure 4-1 Function Block Configuration of a Typical Ratio Control Loop

When the ratio control loop in Figure 4-1 is brought ON LINE, its ON LINE display must be accessed to allow the instrument's SP (Set Point Select) key to be operational. To make the working set point of the ratio control loop equal the equation **(WILD VARIABLE X RATIO SETPOINT) + RATIO BIAS**, then select the TUNE LOOP menu item TOGGLE SETPOINT SOURCE so that an "SP2" is seen in the loop's ON LINE display. Note that within the ratio control loop's programming menu (accessed under PROGRAM CONTROL LOOPS), you will not find a SETPOINT #2 menu choice. The ratio control loop function block operates with the formula **(WILD VARIABLE X RATIO SETPOINT) + RATIO BIAS** assuming all the functionality of the ratio loop's second set point. Pressing the SP key to switch the working set point of a live ratio control loop from SP2 to SP1 will essentially suspend any ratio control and cause the loop to behave like a standard PID controller. This standard PID loop will have a local set point equal to the value programmed for SETPOINT #1. To control the process variable using a fixed set point that is independent of the loop's WILD VARIABLE input, toggle the ratio control loop's working set point to SP1.

4.9 Program Analog Outputs

The analog outputs will be accessible if an analog output board is detected upon power up.

If the instrument will be used for control, program the loops first. See Program Control Loops in Section 4.8.

Select an analog output to program.

Analog output type

Select the output type from Table 4-11.

Table 4-11 Analog Output Types

Type as displaye	Full name of output type
CAT	Current Adjusting Type (Current output)
DAT	Duration Adjusting Type (Time proportioning output)

Table 4-12 shows the prompts for each type of Analog Output.

Table 4-12 Prompts For Analog Output Types

CAT	DAT
IN DECIMAL POS	IN DECIMAL POS
OUT DECIMAL POS	INPUT SOURCE
INPUT SOURCE	INC SLEW LIMIT
IN LOW LIMIT	DEC SLEW LIMIT
IN HIGH LIMIT	IMPULSE TIME
OUT LOW LIMIT	MIN ON TIME
OUT HIGH LIMIT	MIN OFF TIME
INC SLEW LIMIT	FAILSAFE
DEC SLEW LIMIT	FAILSAFE VALUE
FAILSAFE	OUTPUT RELAY
FAILSAFE VALUE	

Table 4-13 describes each prompt.

Table 4-13 Analog Output Prompts

Prompt	Range/Selections	Definition
INPUT SOURCE	Enter OFF, analog parameter, number as the analog output source.	For a control loop, this is typically set to a control output (LP# OV). However, it may be directed to any analog value, such as a calculated value, to retransmit the value to an external device.
INPUT LOW LIMIT	If the AO's input source is a PID control loop, specify a high value of 100 and a low value of 0. For other input sources, specify limits using the same units as the AO's input source.	Input limits. (Variable input limits are available by programming a constant's Destination with HS or LS. See Program Constants, Section 4.16.)
INPUT HIGH LIMIT		
OUTPUT LOW LIMIT	For CAT, enter any output range within 0-20 mA	These limits scale the output to the input limits. For a CAT output a low limit of 4 and high limit of 20 will provide a 4-20 mA output range.
OUTPUT HIGH LIMIT		
INC SLEW LIMIT	Enter OFF or 0.1 to 999.9 units/minute (units of the AO's input source).	Limits the rate of increase or decrease of the analog output. Value entered is in terms of the AO's input source, not in terms of the output as defined by OUTPUT LOW LIMIT & OUTPUT HIGH LIMIT. (Variable slew limits are available by programming a constant's Destination with IS or DS. See Program Constants, Section 4.16.)
DEC SLEW LIMIT		
FAILSAFE	NONE UP (Upscale) DOWN (Downscale) VALUE	Select failure action to occur on input signal loss. If VALUE is selected, enter the value desired in FAILSAFE VALUE
FAILSAFE VALUE	Enter a value between Input Low Limit and Input High Limit or analog parameter or OFF.	The value at which the output will be held for failsafe. This value is also the initial output of the loop on "cold start". If the value is set to OFF, the output will go to 0. Value entered is in terms of the AO's input source, not in terms of the output as defined by OUTPUT LOW LIMIT & OUTPUT HIGH LIMIT.
IMPULSE TIME	OFF or ≥ 1	The cycle time (in seconds) for On and Off time of the output. For example, a time of 150 seconds will cause the output to be on for 75 seconds and off for 75 seconds when the input source is at 50%. (Variable impulse time is available by programming a constant's Destination with IT. Program Constants, Section 4.16.)

Table 4-13 Analog Output Prompts (continued)

Prompt	Range/Selections	Definition
MIN ON TIME	OFF or ≥ 0	The minimum on time (in seconds) for the output. If the input source calls for the output to be on for less than this time, the output will not turn on at all. Example 1 Impulse Time = 100. Min On Time = 5 seconds. The output will not come on unless the input source is ≥ 5%. For instance, if input source = 3%, output would be on for 3% of impulse time, or 3 seconds, but since 3 seconds is less than the Min On Time, output will not turn on. Example 2 Impulse Time = 150. Min On Time = 3 seconds. The output will not come on unless the input source is ≥ 2%. For instance, if input source = 1%, output would be on for 1% of impulse time, or 1.5 seconds, but since 1.5 seconds is less than the Min On Time, output will not turn on.
MIN OFF TIME	OFF or number	The minimum off time (in seconds) for the output. If the input source calls for the output to be off for less than this time, the output will not turn off at all. Example 1 Impulse Time = 100. Min Off Time = 5 seconds. The output will not turn off unless the input source is ≤ 95%. For instance, if input source = 98%, output would be off for 2% of impulse time, or 2 seconds, but since 2 seconds is less than Min Off Time, output will not turn off. Example 2 Impulse Time = 150. Min Off Time = 3 seconds. The output will not turn off unless the input source is ≤ 98%. For instance, if input source = 99%, output would be off for 1% of impulse time, or 1.5 seconds, but since 1.5 seconds is less than the Min Off Time, output will not turn off.
OUTPUT RELAY	Select discrete output channel.	This is the discrete output channel if using DAT output algorithm. This discrete output will be unprogrammable under the PROGRAM DISCRETE OUTPUTS programming menu. Only discrete outputs 1 though 5 will be programable on any of the installed discrete output cards. Programming of discrete output 6 is not allowed.

ATTENTION

ON/OFF loop types provide direct output without the use of an analog output. To complete an ON/OFF loop configuration, assign the ON/OFF loop's output (LPn OS) to a Discrete Output Relay. (see Program Discrete Outputs, section 4.11).

4.10 Program Discrete Inputs

Discrete Input function blocks are controlled by the on/off status of the input hardware. The output of the function block, DIn OS, reflects the status of the associated input hardware. This output DIn OS can be connected to other function blocks' input parameters to trigger actions such as starting a profile or selecting a control loop's Set point #1 or Set point #2, among many other possibilities.

The Program Discrete Input menu item will appear if a DI/DO card is installed.

Select a discrete input to program, then program the prompts in Table 4-14. See Table 4-2 for additional prompts.

Table 4-14 Discrete Input Prompts

Prompt	Range/Selections	Definition
ACTION STATE	NORMAL, INVERT	Determines whether the input will be normally closed or normally open when ON(1). To select closed when ON (1), enter NORMAL (not inverted). To select closed when OFF(0), enter INVERT (inverted).
DELAY TIME	Number of seconds	When the DI is placed in its ON(1) state, the DI function will wait for the specified delay time before indicating the ON(1) condition as an output. If the DI "ON" state changes before the delay time expires, no ON output will be indicated.
EVENT ENABLE	NONE, RISING, FALLING, BOTH	Determines whether changes in DI's status can be recorded as events in data storage. NONE - status changes are not stored RISING - OFF(0)-to-ON(1) changes can be stored FALLING - ON(1)-to-OFF(0) changes can be stored BOTH - Both changes can be stored

4.11 Program Discrete Outputs

Discrete Output function blocks control the relay or open collector output hardware. The Program Discrete Outputs menu item will appear if a Discrete Outputs board is installed.

ATTENTION

If a discrete output has been assigned to a time proportioning output (DAT), it will not be programmable here. See "OUTPUT RELAY" in Table 4-13.

Select a DO to program, then program the prompts in Table 4-15. See Table 4-2 for additional prompts.

Table 4-15 Discrete Output Prompts

Prompt	Range/Selections	Definition
ACTION STATE	NORMAL, INVERT	Determines whether the relay will normally be energized or de-energized when the DO's Input is ON(1). To select *energized when ON, enter* NORMAL (not inverted). To select *energized when OFF, enter* INVERT (inverted).
INPUT	OFF, discrete parameter, 0, 1	Source of the Discrete Output.
EVENT ENABLE	NONE, RISING, FALLING, BOTH	Determines whether changes in DO's status can be recorded as events in data storage. For storage to occur, Data Storage must also be programmed to store Events. NONE - status changes are not stored RISING - OFF(0)-to-ON(1) changes can be stored FALLING - ON(1)-to-OFF(0) changes can be stored BOTH - Rising and falling changes can be stored

4.12 Program Calculated Values

A Calculated Value (CV) is a data point whose value is derived from calculations involving other data points. The CV Output can be analog or discrete. A CV can include other CVs in its calculations. Once a CV is created, it can be used by any function block as many times as desired.

Select "CALCULATED VALUES" on the Main Program Menu. Select a CV to program, then choose from the types shown in

Table 4-16.

ATTENTION

- If you plan to program another function block using a Calculated Value as a parameter, you must program the Calculated Value first.
- Once you change the type and press Enter, the previous type's settings are deleted and cannot be recovered.
- If your unit has the "standard math" package, you still have access to "advanced math" package types but the fields will be blank and unaccessible.

Table 4-16 CV Types

Type	Math Package	Description	Pag
NONE		No CV Programmed	--
PEAK PICKING	A	Picks maximum input value	107
SIGNAL SELECT	A	Selects signal per your criteria	108
COMPARE	A	Compares input and outputs result	109
COUNTER	A	Counts transitions of input status	113
MATH	S	Calculates math on 8 inputs using one operator	114
FREE FORM MATH	S	Calculates math on 8 inputs using several operators	115
LOGIC	S	Outputs logic of inputs	117
FREE FORM LOGIC	S	Outputs logic of inputs using custom equation	119
INVERTER	S	Inverts status of input	120
BCD	S	Binary Coded Decimal conversion	121
FUNCTION GENERATOR	A	Generates custom y = f(x) curve	123
INTERVAL TIMER	A	Counts time in minutes	125
PERIODIC TIMER	S	Generates periodic pulse	126
MASS FLOW	A	Calculates mass flow with square root	128
CARBON POTENTIAL	A	Generates a %C value	129
RELATIVE HUMIDITY	A	Calculates relative humidity	131
STERILIZATION	A	Calculates F_0 Sterilization	132
ADV SPLITTER	A	Splits input into 3 outputs	133
STD SPLITTER	A	Splits input into 2 outputs	135
SCALING	A	Scales input to output	136
SIGNAL CLAMP	A	Clamps input to specified values	137
1 PT BLOCK AVG	A	Averages one input	138
ROLLING AVG	A	Computes rolling average of one input	139
MULTIPLE AVG	A	Averages multiple inputs	140
CEM BLOCK AVG	A	Averages one input over specified intervals	141
CEM ROLLING AVG	A	Computes rolling average of one input over specified intervals	142
S: Standard Math package A: Advanced Math package			

Refer to the page shown for the desired CV programming procedures. Press Enter when the "PRESS ENTER TO SAVE" prompt appears to save your entries made during the session.

Peak Picking

This type monitors the input and determines a “peak” value reached during the specified time interval (in minutes). The peak can be chosen to be a maximum, minimum, average, or standard deviation. At the end of the time interval, the output CVn OV steps to the value of the peak and holds this value until the end of the next time interval. If the Reset Input turns ON(1), the output is held and the time interval restarts.

Table 4-17 describes the Peak Picking prompts. See Table 4-2 for additional prompts.

Table 4-17 Peak Picking Prompts

Prompt	Range/Selections	Definition
RANGE LOW	OFF or number	Enter the output's display limits. Output is not clamped or flashed when it exceeds these limits.
RANGE HIGH		
INPUT	OFF, analog parameter, number	Input source whose peak is picked
RESET	OFF, discrete parameter, 0, 1	Holds output and restarts time interval
ACTION	NONE, MIN, MAX, AVG, STDDEV	Type of peak pick. MIN selects the minimum, MAX selects the maximum, AVG selects the mean average, STDDEV selects the standard deviation over the time interval.
PERIOD MINUTES	0-999,999.9	Number of minutes in time interval

Signal Select

Selects one of 48 inputs based on the action and outputs it as CVn OV.

Table 4-18 describes the Signal Select prompts. See Table 4-2 for additional prompts.

Table 4-18 Signal Select Prompts

Prompt	Range/Selections	Definition
OUTPUT LOW LIMIT	OFF or number	Displayed output value will be clamped and will flash when these limits are exceeded.
OUTPUT HIGH LIMIT		
INPUT #1 - INPUT #48	OFF, analog parameter, number	Up to 48 input sources to be selected from according to the ACTION.
ACTION	HIGH	Selects the highest value input.
	LOW	Selects the lowest value input.
	AVG	Averages the input values.
	MIDDLE	Selects the middle (median) input value. If the number of inputs is even, selects the sum of the middle two input values divided by 2.
	F-GOOD	(First Good) If inputs fail, selects the first good input to the function block. For example, if inputs 1 and 2 fail, then input 3 is selected.
	ANA-SW	(Analog Switch) Selects an input equal to the value of the ANALOG SELECT parameter.
	DIS-SW	(Discrete Switch) Selects Input #1 or #2 according to state of DISCRETE SELECT.
ANALOG SELECT	OFF, analog parameter, number	Example: if ASEL=3, then Input #3 is selected. If ANALOG SELECT < 1, Input #1 is selected. The value of ANALOG SELECT is truncated to a whole number. For example, if ANALOG SELECT is 3.55, the value is truncated to 3 and Input #3 is selected.
DISCRETE SELECT	OFF, discrete parameter, 0, 1	Selects Input #1 when DISCRETE SELECT is off (0); selects Input #2 when DISCRETE SELECT is ON (1). Inputs 3-48 are unused.

Compare

Compare can be used instead of an Alarm's output to control a relay. It can also provide on/off control with hysteresis.

Compares 2 inputs. Call the result of this comparison "Result". Result is a pulse that goes ON(1) when comparison is true, and OFF(0) when comparison is not true. If hysteresis is given a value, then Result will not go OFF(0) until hysteresis value is exceeded. Result is then processed according to the specified condition type and condition time. The final output is a discrete pulse CVn OS.

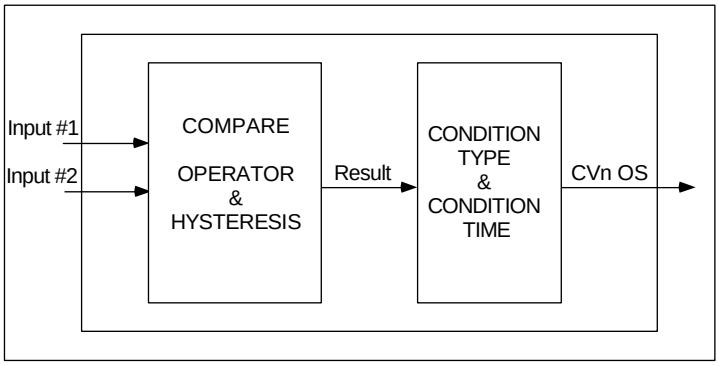


Figure 4-2 Compare Signal Flow

Table 4-19 and Table 4-20 describe the Compare prompts. See Table 4-2 for additional prompts.

Table 4-19 Compare Prompts

Prompt	Range/Selections	Definition
INPUT #1	OFF, analog parameter, number	Input sources to be compared.
INPUT #2		
OPERATOR	EQ, GT, LT, GTE, LTE, NEQ	The Result will be set to ON(1) when the comparison is true: Input #1 OPERATOR Input #2 where OPERATOR is: EQ(=), GT(>), LT(<), GTE (≥), LTE (≤), NEQ(≠) The Result will be set to OFF(0) when the comparison is false.
HYSTERESIS	Number, OFF	Applies to all operators except EQ and NEQ. If given a value, hysteresis determines when Result goes OFF(0) after the comparison becomes false. Operator — Hysteresis Function GT: Result goes OFF when Input #2 - Input #1 ≥ Hyst GTE: Result goes OFF when Input #2 - Input #1 > Hyst LT: Result goes OFF when Input #1 - Input #2 ≥ Hyst LTE: Result goes OFF when Input #1 - Input #2 > Hyst See Figure 4-3.
CONDITION TYPE	NONE, DELAY, EXTEND, PULSE, RT PULSE	See Table 4-20.
CONDITION TIME	OFF or number	Enter number of seconds of condition time. See Table 4-20.

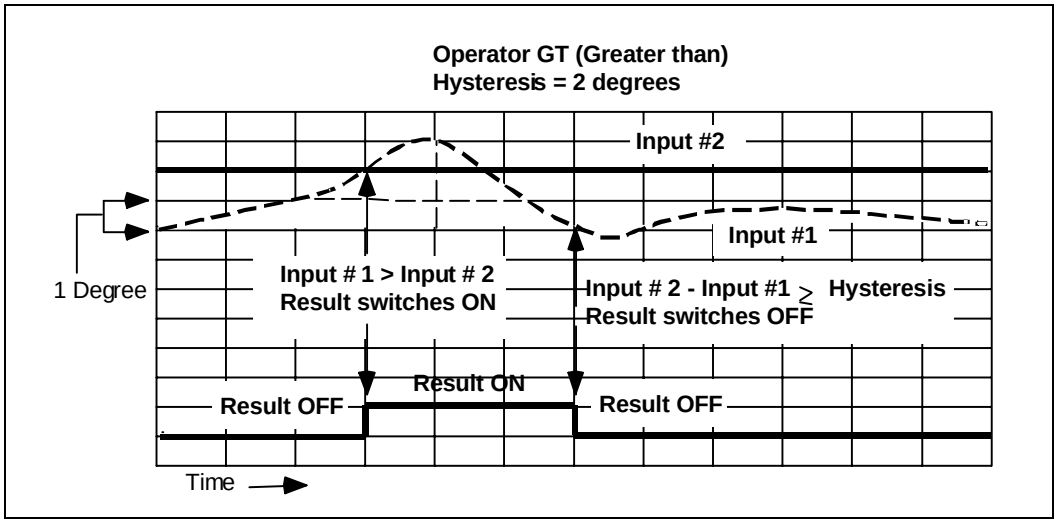
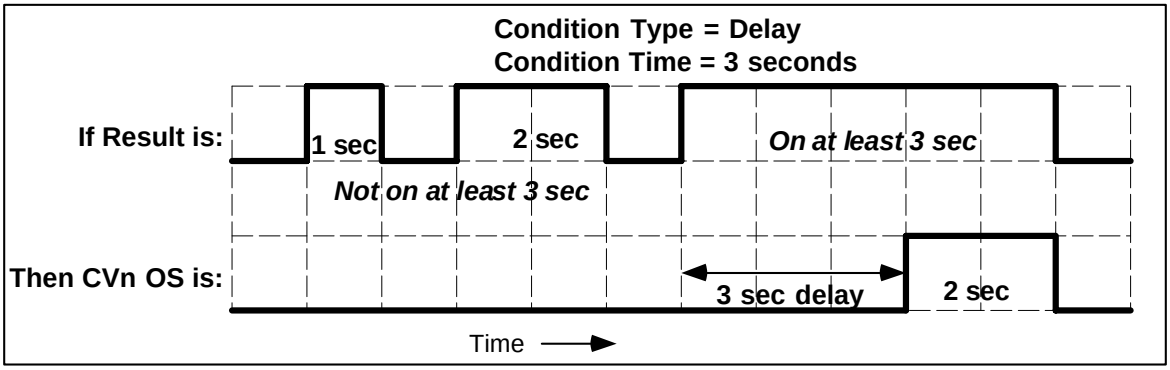


Figure 4-3 Compare's Greater Than Result, With Hysteresis

Table 4-20 Compare's Condition Type and Condition Time Prompts

Condition type	Application	If this is true	then CVn OS is
NONE	--	Result	Result

Condition type	Application	If this is true	then CVn OS is
DELAY	Filters short pulses Delays rising edge of Result for CONDITION TIME	Result switches ON(1) for n seconds ≥ CONDITION TIME.	ON n seconds minus CONDITION TIME
		Result switches OFF(0)	OFF(0)



Condition type	Application	If this is true	then CVn OS is
EXTEND	Used for interfacing with slower circuits. Extends falling edge of Result for CONDITION TIME.	Result switches ON(1) for n seconds, then OFF(0)	ON(1) for n seconds plus CONDITION TIME, then OFF(0)
		Result switches ON(1)	ON with no delay

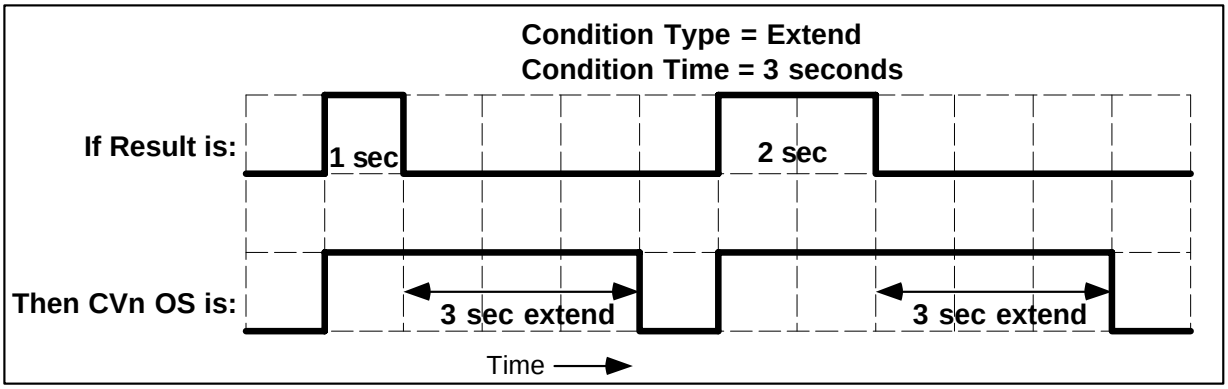
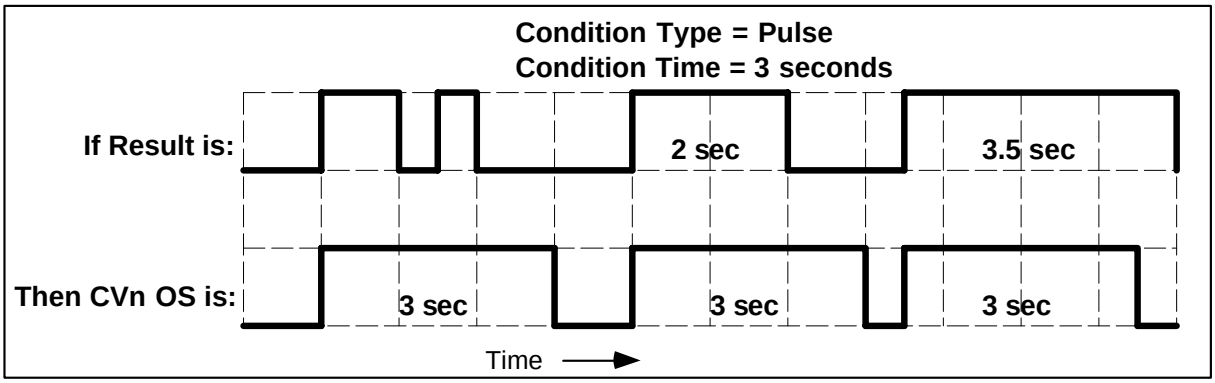
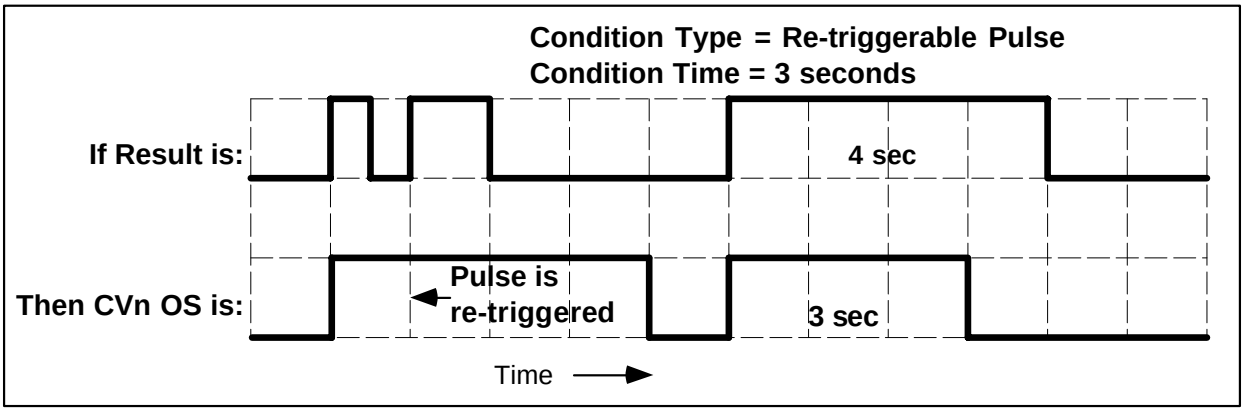


Table 4-20 Compare's Condition Type and Condition Time Prompts (continued)

Condition type	Application	If this is true	then CVn OS is
PULSE	Used for interfacing with slower circuits. On rising edge of Result, creates pulse length CONDITION TIME and ignores additional rising edges of Result within that CONDITION TIME.	Result switches ON(1) for ≤ CONDITION TIME, then OFF(0).	ON(1) for CONDITION TIME, then OFF(0). During CONDITION TIME, any additional OFF(0)-to-ONs of Result are ignored.



Condition type	Application	If this is true	then CVn OS is
RT PULSE (Re-triggerable pulse)	Used for slower circuits.	Result switches ON(1) for ≤ CONDITION TIME, then OFF(0)	ON(1) for CONDITION TIME, then OFF(0).
	Guarantees that CVn OS will be ON for CONDITION TIME after most recent rising edge of Result.	Result switches ON(1) multiple times before CONDITION TIME expires	ON(1) when Result first switches ON(1) and remains ON(1) until Result has not switched ON(1) for CONDITION TIME.
		Result switches ON(1) for ≥ CONDITION TIME, then OFF(0)	ON(1) for CONDITION TIME then OFF(0).



Counter

Counts the number of OFF(0)-to-ON(1) transitions of the input. This number is output as CVn OV. When this number reaches the Preset value, a discrete output parameter CVn OS goes ON(1) until Reset occurs.

Table 4-21 describes the Counter prompts. See Table 4-2 for additional prompts.

Table 4-21 Counter Prompts

Prompt	Range/Selections	Definition
RANGE LOW	OFF or number	Enter the output's trend display limits. Output is not clamped or flashed when it exceeds these limits.
RANGE HIGH		
INPUT	OFF, discrete parameter, 0, 1	Input source.
RESET	OFF, discrete parameter, 0, 1	When Reset is level high, output state (OS) is ON and the counter resets to zero if counting up or to the Preset value if counting down from it. When Reset is level low, counter resumes counting.
PRESET	OFF, analog parameter, number	The number of input transitions after which the CVn OS output will go ON(1). To count forever, set to OFF. If OFF, CVn OS will not be triggered.
COUNT DOWN	YES or NO	Select NO to count up from zero to the Preset value; YES to count down from the Preset value to zero. If Preset is OFF, Count Down must be NO.

Math

Performs math on up to 8 inputs using a single operator. Output is CVn OV. Division by 0 is indicated by CVn OV's displayed value flashing 0.

Table 4-22 describes the Math prompts. See Table 4-2 for additional prompts.

Table 4-22 Math Prompts

Prompt	Range/Selections	Definition
INPUT A - INPUT H	OFF, analog parameter, number.	Enter up to 8 input sources. If connecting to an upstream loop, that loop output (LP# OV) MUST be INPUT A (see Feedback).
OUTPUT LOW LIMIT OUTPUT HIGH LIMIT	Enter limits	Displayed output value will be clamped and will flash when these limits are exceeded.
OPERATOR	ADD, SUBT, MULT, DIV, ABSVAL, SQRT and STDDEV.	1. Input A OPERATOR Input B OPERATOR...Input H where OPERATOR is one of these: add, subtract, multiply, or standard deviation (Standard Deviation uses all inputs.) Example: Input A minus Input B minus ...Input H. 2. OPERATOR Input A where OPERATOR is absolute value or square root. 3. Input A OPERATOR Input B where OPERATOR is divide. Note: Inputs 3-8 are not used in division.
FEEDBACK	OFF, analog parameter, number	Select LP# BC or AO# BC to propagate the back calculation (BC) value from a downstream loop or AO. Also, program the upstream loop's feedback with this Math CV's back calculation value (CV# BC). You MUST program this CV's feedback to NONE if this CV is not used as part of a control loop output configuration (Figure 4-4). If it is part of a loop configuration, the math operator cannot be ABSVAL, SQRT, or STDDEV.

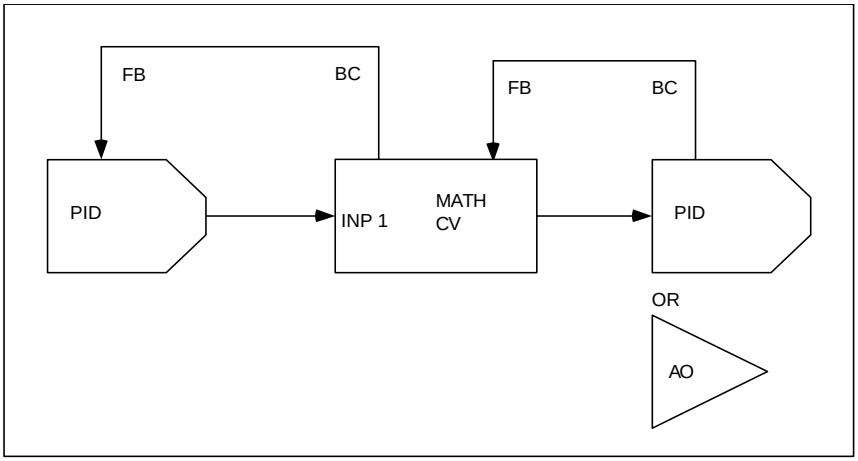


Figure 4-4 Math CV Feedback Programming

Free Form Math

The output CVn OV is the result of a user-specified equation. QWERTY keyboard may be used for easier equation entry.

Table 4-23 describes the Free Form Math prompts. See Table 4-2 for additional prompts.

Table 4-23 Free Form Math Prompts

Prompt	Range/Selections	Definition
OUT LOW LIMIT OUT HIGH LIMIT	OFF or number	• Displayed output value will be clamped and will flash when these limits are exceeded.
EQ	See Table 4-24.	• Enter the equation using the keyboard. • See Table 4-24 for allowable characters and functions. • Enter up to 64 characters (upper or lower case) • Spaces are permitted. • Enclose a function's argument with parentheses (). • Square root argument must be absolute value to prevent square root of a negative value. • Only whole numbers may be used as exponents. Example: To input this equation $\text{CN 5 OV X 12} \sqrt{\frac{\text{AI 1 OV}}{\text{AI 2 OV}}} + 5$ enter these settings: INPUT A: CN5OV INPUT B: 12.0 INPUT C: AI1OV INPUT D: AI2OV EQ: A*B*SQRT (ABS(C/D))+5 Note how constants can be entered through the Constant function block (as in example's Input A), assigned to an input (as in example's Input B), or entered directly in the equation (as in example with 5).
INPUT A - INPUT H	OFF, analog parameter, number	Enter the parameters or numbers to be used in the equation.
RESET	OFF, discrete parameter, 0, 1	Resets the function block. Use only when the equation result is the input to itself (integrating); that is, when the equation contains the letter O.

Table 4-24 Free Form Math Functions

For this function or value	Type this in the equatio
n (constant)	*n*
Negation (-*n*)	NEG(*n*)
Value of Input A	A
Value of Input B	B
Value of Input C	C
Value of Input D	D
Value of Input E	E
Value of Input F	F
Value of Input G	G
Value of Input H	H
Add	+
Subtract	-
Multiply	*
Divide	/
Constant number	*n (for example, 123.45)*
Absolute value of *n*	ABS(*n*)
Square root of *n*	SQRT(*n*)
y^n	y^*n*
e^x where x=*n*	EX(*n*)
Log base 10 of *n*	LOG(*n*)
Natural log of *n*	LN(*n*)
Integration: Result of equation as of last machine cycle	O *(Letter 'O', not zero '0'.)*

Logic

The input or inputs are processed by a logic operator. Call the result of this logic operation “Result”. Result is a pulse that goes ON(1) when the logic is true, and OFF(0) when the logic is not true. Result is then processed according to the specified condition type and condition time. The final output is a discrete pulse CVn OS. See Figure 4-5.

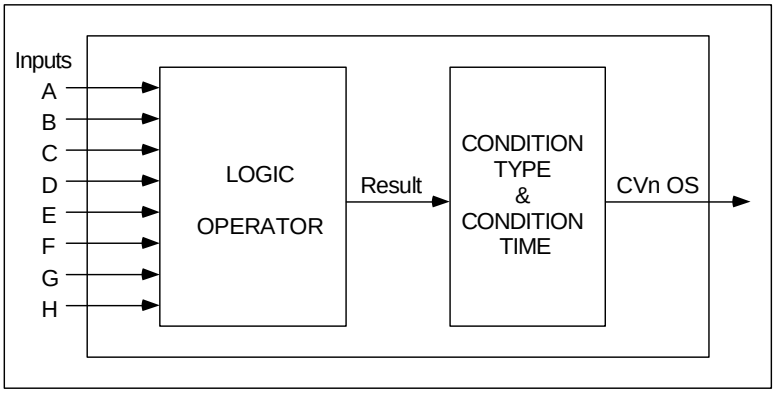


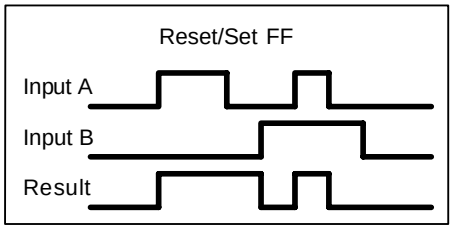
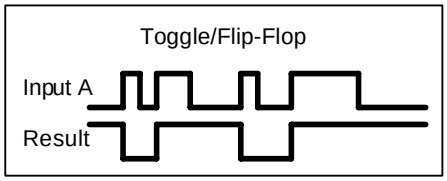
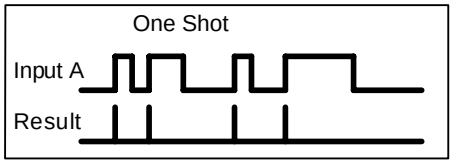
Figure 4-5 Logic Signal Flow

Table 4-25 describes the Logic prompts. See Table 4-2 for additional prompts.

Table 4-25 Logic Prompts

Prompt	Range/Selections	Definition
OPERATOR	AND, OR, XOR, RESET/SET FF, TOGGLE/FF, ONE SHOT, PASS	See Table 4-26.
INPUT A	OFF, discrete parameter, 0, 1.	Program at least 2 inputs. Only inputs programmed with parameter, 1, or 0 are processed with the operator.
INPUT B		
INPUT C		
INPUT D		
INPUT E		
INPUT F		
INPUT G		
INPUT H		
CONDITION TYPE	NONE, DELAY, EXTEND, PULSE, RT PULSE	See Table 4-20 on page 111.
CONDITION TIME	OFF or number	Enter number of seconds of condition time. See Table 4-20 on page 111.

Table 4-26 Logic Operators

For this operator	Definition	if this is true	then Result is
AND	If all programmed inputs are ON, Result is ON.	All programmed inputs are ON(1)	ON(1)
OR	If at least 1 programmed input is ON, Result is ON.	At least 1 programmed input is ON(1)	ON(1)
XOR	Uses Inputs A and B only.	Input A is ON(1) and Input B is OFF(0).	ON(1)
	If one and only one input is ON, Result is ON.	Input A is OFF(0) and Input B is ON (1).	ON(1)
RESET/SET FF	Rising edge of Input A turns Result ON.	Input A is ON(1).	ON(1)
(Reset/Set Flip-Flop)	Rising edge of Input B resets Result.	Input A is OFF(0) and Input B is ON (1).	OFF(0)
			
TOGGLE/FF	Toggle Flip-Flop. Rising edge of Input A inverts Result	Input A changes from OFF(0) to ON(1) (rising edge)	ON(1) if it was OFF(0), or OFF(0) if it was ON(1).
		Input A changes from ON(1) to OFF(0) (falling edge)	unchanged
			
ONE SHOT	Rising edge of Input A turns Result ON for one machine scan cycle.	Input A is ON(1) for any length of time	ON(1) for 1 scan cycle of the instrument, then OFF(0)
			
PASS	Passes Input A's state unchanged to CONDITION TYPE.	Input A changes state	same as Input A

Free Form Logic

Lets you enter up to 64 characters as a custom logic equation (EQ) containing inputs and logical operators. The result of this equation is called “Result”. Result is then processed according to the specified condition type and condition time. The final output is CVn OS. See Figure 4-6.

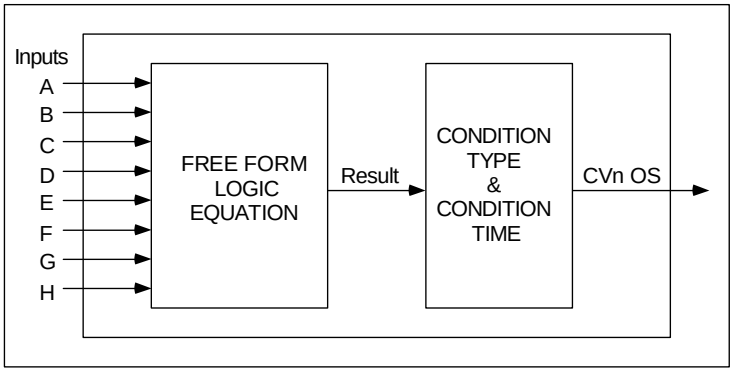


Figure 4-6 Free Form Logic Signal Flow

Table 4-27 describes the Free Form Logic prompts. See Table 4-2 for additional prompts.

Table 4-27 Free Form Logic Prompts

Prompt	Range/Selections	Definition
EQ	*	Symbol for AND operator
	+	Symbol for OR operator
	^	Symbol for XOR operator
	NEG	Symbol for NOT operator
	A, B, C, D, E, F, G, H	Symbols for Input A through Input H
	O	Letter O is the symbol for output CVn OS from the previous logic calculation. Use for iterative calculations.
	1	One = ON
	0	Zero = OFF
	( )	Expressions enclosed by parentheses are evaluated first.
INPUT A - INPUT H	OFF, discrete parameter, 0, 1.	Up to 8 input sources.
RESET	OFF, discrete parameter, 0, 1	Resets the output to OFF (0). Use when using the letter O in equations.
CONDITION TYPE	NONE, DELAY, EXTEND, PULSE, RT PULSE	See Table 4-20 on page 111.
CONDITION TIME	OFF or number	Enter number of seconds of condition time. See Table 4-20 on page 111.

Order of evaluation

1. Parentheses ()
2. NOT
3. AND
4. OR, XOR

Example equation using operators and inputs

(A+B)*C computes the result of (A OR B) AND C.

Table 4-28 (A OR B) AND C

A	B	C	Result
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

Example equation using iteration

The equation A+B*O computes the result of:

(Input A OR Input B from current machine cycle) AND (Input A OR Input B from previous machine cycle). Table 4-29 shows some possible results of this equation.

Table 4-29 Results of Logic Equation Using Iteration

[Input A (current) OR	Input B (current)] AND	[Input A (previous) OR	Input B (previous)]	= Result
1	1	1	1	1
1	0	1	0	1
0	0	1	0	0
1	0	0	0	0

Inverter

The output CVn OS is the logical inverse of the input parameter.

Table 4-30 describes the Inverter prompts. See Table 4-2 for additional prompts.

Table 4-30 Inverter Prompts

Prompt	Range/Selections	Definition
INPUT	OFF, discrete parameter, 0, 1	Input source to be inverted.

BCD

Converts up to 8 discrete inputs' binary coded decimal into an unsigned integer and output the integer as CVn OV. For example, 00000100 = 4.

On the instrument, when the enable is triggered, the set point program specified by the value of CVn OV is copied from internal storage to the Profile function block(s) where the profile(s) can be programmed or executed.

Table 4-31 describes the BCD prompts. See Table 4-2 for additional prompts.

Table 4-31 BCD Prompts

Prompt	Range/Selections	Definition
OUT LOW LIMIT	OFF or number	Displayed output value will be clamped and will flash when these limits are exceeded.
OUT HIGH LIMIT		
BIT 0 through BIT 7	OFF, discrete parameter, 0, 1	The binary coded decimal represented by the states of these discretes will be converted into an unsigned integer. BIT 7 is the most significant bit and BIT 0 is the least significant bit.
ENABLE	OFF, discrete parameter, 0, 1	On the instrument, when this discrete transitions from off(0) to on(1), the specified program's profile(s) will be loaded from internal memory to the Profile function block(s). See Table 4-32.

Example #1, loading a 2-profile program

You are programming a 2-programmer instrument. According to Table 4-32, a 2-programmer instrument can run 2 profiles at a time and can store in its internal memory up to 6 programs, each containing 2 profiles.

Suppose the BCD bits are programmed as follows: Bit 2 = 1, Bit 1 = 1, Bit 0 = 0. This sequence of bits equals the number 6 and is the value of CVn OV. When the Enable discrete is triggered ON(1), the profiles in Program #6 will be loaded from internal memory into the function blocks for Profile #1 and Profile #2, where they can be edited or run.

Example #2, loading a 4-profile program

You are programming a 4-programmer instrument. According to Table 4-32, a 4-programmer instrument can run 4 profiles at a time and can store in its internal memory up to 3 programs, each containing 4 profiles.

Suppose the BCD bits are programmed as follows: Bit 2 = 0, Bit 1 = 1, Bit 0 = 0. This sequence of bits equals the number 2 and is the value of CVn OV. When the Enable discrete is triggered ON(1), the profiles in Program #2 will be loaded from internal memory into the function blocks for Profiles #1 through #4, where they can be edited or run.

Table 4-32 How Profiles Are Saved In Memory

1-programmer instrument 1 Profile per Program		2-programmer instrument 2 Profiles per Program		3-programmer instrument 3 Profiles per Program		4-programmer instrument 4 Profiles per Program	
This Program. .	**…contain this Profil**	**This Program. .**	**…contain these Profiles**	**This Program. .**	**…contains these Profiles**	**This Program. .**	**…contain these Profiles**
1	1	1	1	1	1	1	1
2	1		2		2		2
3	1	2	1		3		3
4	1		2	2	1		4
5	1	3	1		2	2	1
6	1		2		3		2
7	1	4	1	3	1		3
8	1		2		2		4
9	1	5	1		3	3	1
10	1		2	4	1		2
11	1	6	1		2		3
12	1		2		3		4
•		•		•		•	
•		•		•		•	
•		•		•		•	
93	1	47	1	•		24	1
94	1		2	32	1		2
95	1	48	1		2		3
96	1		2		3		4

Function Generator

This CV type can be used to characterize a valve (Figure 4-8) or an input signal (Figure 4-9). You enter a custom curve of up to 19 segments (20 X,Y coordinates). The input is compared with the X values and its corresponding Y value becomes the output CVn OV. Interpolation between coordinates is straight line. See Figure 4-7.

If the input value is outside the range of X values, the nearest X value is used, the output will be clamped to the corresponding Y value and the displayed output value will flash.

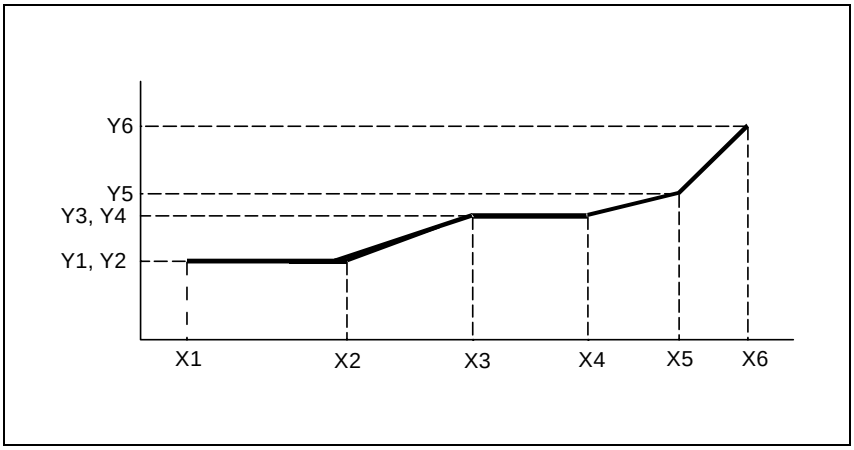


Figure 4-7 Function Generator Curve

Table 4-33 describes the Function Generator prompts. See Table 4-2 for additional prompts.

Table 4-33 Function Generator Prompts

Prompt	Range/Selections	Definition
RANGE LOW	OFF or number	Enter the output's lower display limit. Output is not clamped or flashed when it exceeds this limit. Default value is Y1 value.
RANGE HIGH	OFF or number	Enter the output's lower display limit. Output is not clamped or flashed when it exceeds this limit. Default value is Y1 value.
INPUT	OFF, analog parameter, number	This value will be compared with the X values of the curve. The corresponding Y value will be the CV output.
X1, Y1, X2, Y2…X20, Y20	OFF or number	Use these prompts to plot a curve using 2 to 20 X,Y coordinates. X values must increase as Xn increases.
FEEDBACK	OFF, analog parameter, number	For valve characterization, select AO# BC to propagate the back calculation (BC) value from a downstream Analog Output. Also, program the upstream loop's feedback with this CV's back calculation value (CV# BC). See Figure 4-8. ***Attention:*** If feedback is programmed to an analog parameter or a number, the X and Y values must define a curve that is not bell shaped or complex. That is, all Y values must be increasing or decreasing.

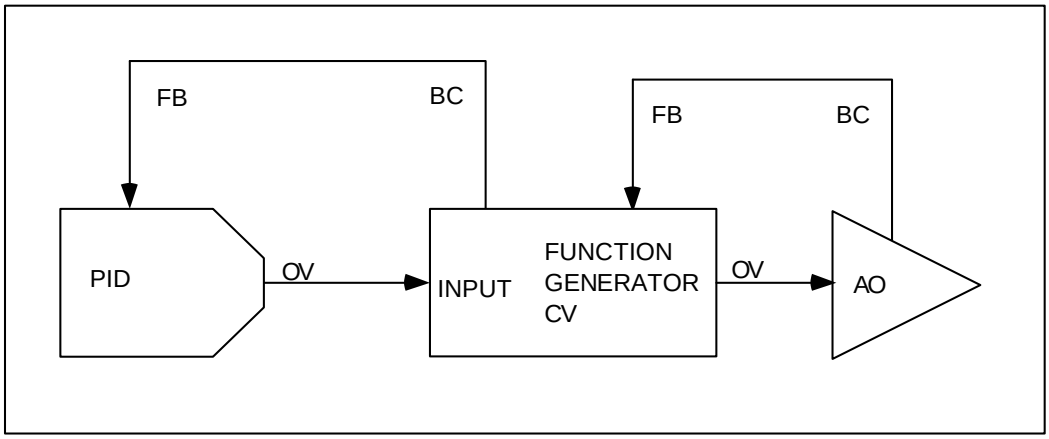


Figure 4-8 Function Generator Configuration For Valve Characterization

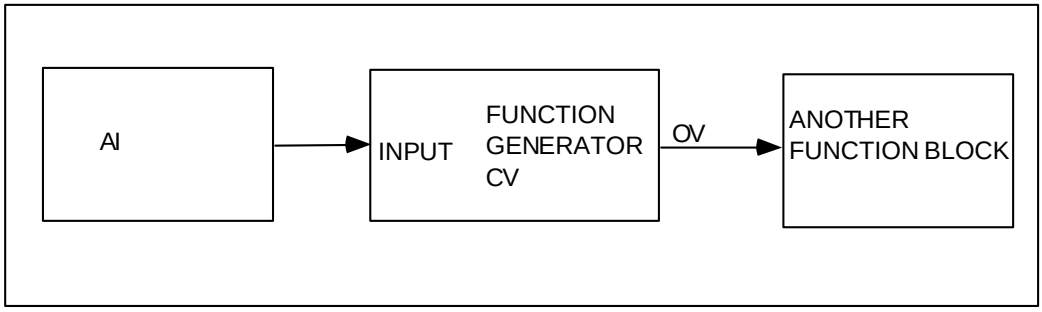


Figure 4-9 Function Generator Configuration For Input Signal Characterization

Interval Timer

This timer counts down from the preset value in minutes. This time remaining is CVn OV. The timer has a single discrete output CVn OS which is ON(1) while the timer is actively counting or while RESET is ON(1), and OFF(0) while the timer has timed out to zero. When RESET/RUN switches ON(1) the timer resets to the preset value; an ON(1) to OFF(0) transition starts the timer.

Table 4-34 describes the Interval Timer prompts. See Table 4-2 for additional prompts.

Table 4-34 Interval Timer Prompts

Prompt	Range/Selections	Definition
PRESET	OFF, analog parameter, number	Timer counts to zero from this number of minutes.
RESET/RUN	OFF, discrete parameter, 0, 1	Controls the operation of the timer.
RANGE LOW	OFF or number	Enter the output's display limits. Output is not clamped or flashed when it exceeds these limits.
RANGE HIGH		

Periodic Timer

Generates a discrete output pulse CVn OS which is ON(1) for 1 machine cycle (250ms, 500ms, 1 sec) at specified Start time and repeated at a specified Period thereafter. Use this to activate a discrete parameter at a particular time and at regular intervals.

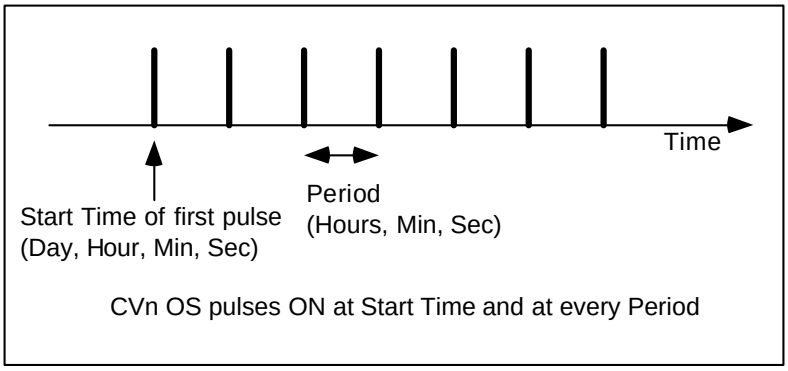


Figure 4-10 Periodic Timer

Table 4-35 describes the Periodic Timer prompts. See Table 4-2 for additional prompts.

Table 4-35 Periodic Timer Prompts

Prompt	Range/Selections	Definition
SET UP TIMER	See Table 4-36 for prompts	Selects the timer format.

Table 4-36 Set Up Timer Prompts

Prompt	Range/Selections	Definition
PHASE	NONE, DAILY, WEEKLY, MONTHLY	Select the timer format. Remaining prompts will vary per phase selected.
PERIOD HOURS	0-23	Number of hours in the period
PERIOD MINUTES	0-59	Number of minutes in the period
PERIOD SECONDS	0-59	Number of seconds in the period
RESET	OFF, discrete parameter, 0, 1	Phase NONE only. When this discrete is ON(1), timer stops and resets to beginning of period. When discrete is OFF(0), timer begins again.
START DAY	MONDAY, TUESDAY…SUNDAY	For Phase DAILY, select the day of the week to start the timer.
	1-31	For Phase MONTHLY, select the day of the month to start the timer. If this number exceeds the number of days in any given month, then the discrete switches ON(1) the last day of that month.
START HOURS	0-23	Hours of the Start time.
START MINUTES	0-59	Minutes of the Start time.
START SECONDS	0-59	Seconds of the Start time.

ATTENTION

The Start Time's value cannot exceed the Period. An error message is displayed if you enter a Start Time of 8:00:00 and a Period of 4:00:00, for example.

Mass Flow

By compensating for variations in fluid temperature and pressure, Mass Flow is used to obtain a more precise fluid flow measurement from an orifice plate developing a differential pressure. The output CVn OV is mass flow and is calculated from the following formula for U.S. Units Of Measurement:

MF = FACTOR 1 x SQRT [DP INPUT x (PRESSURE INPUT+14.7) / (TEMPERATURE INPUT + 459)]

where

FACTOR 1 is calculated by user

DP INPUT is differential pressure in inches of water

PRESSURE INPUT is in PSIG

TEMPERATURE INPUT is in °F

Or, Mass flow is calculated from the following formula for International Units Of Measurement:

MF = FACTOR 1 x .569 x SQRT [DP INPUT x (PRESSURE INPUT +101.4)/(TEMPERATURE INPUT + 273)]

where

FACTOR 1 is calculated by user

DP INPUT is differential pressure in KPASCALS

PRESSURE INPUT is in KPASCALS

TEMPERATURE INPUT is in °C

Table 4-37 describes the Mass Flow prompts. See Table 4-2 for additional prompts.

Table 4-37 Mass Flow Prompts

Prompt	Range/Selections	Definition
OUT LOW LIMIT	OFF or number	Displayed output value will be clamped and will flash when these limits are exceeded.
OUT HIGH LIMIT		
DP INPUT	OFF, analog parameter, number	Differential pressure input
PRESSURE INPUT	OFF, analog parameter, number	Pressure input in PSIG or KPASCALS
TEMP INPUT	OFF, analog parameter, number	Temperature in °C or °F
UNITS OF MEASURE	US or International	Units of measure
FACTOR 1	OFF, analog parameter, number	Flow factor for the particular installation

Carbon Potential

The Carbon Potential Control Function Block provides for weight percent (wt%) control of carbon in carburizing, hardening, and atmosphere generating applications.

Table 4-38 Carbon Prompts

Prompt	Range/Selections	Definition
PROBE TYPE	NONE, AACP, SUPER SYS, MARATHON, FCC	Selection which represents the manufacturer of the oxygen probe being used. This determines which linearization equations are used for %C and dewpoint calculations.
CARBON PROBE IN	NUMBER, PARM, OFF	Analog input that is connected to the oxygen probe mV output.
PROBE TEMP INPUT	NUMBER, PARM, OFF	Analog input that is connected to the oxygen probe temperature output.
TEMPERATURE UNIT	NONE, F, C, K, R	Temperature scale for this block. This selection must match the temperature scale of the analog input that is connected to the oxygen probe temperature output.
TEMP LOW LIMIT	NUMBER, OFF	Probe temperature value below which this block's low temperature discrete output (OS) is turned ON. This limit and subsequent discrete output may be used to force the control loop's output to a known value when the probe temperature is too low for carbon potential control.
CO COMPENSATION	NUMBER, PARM, OFF	Number used in the %C calculation which represents the %CO present in the endothermic gas.
FURNACE FACTOR	NUMBER, PARM, OFF	Correction factor used to account for environmental variation within the furnace chamber. In units of %C, this factor is added directly to the %C value calculated from probe output linearization.
SOOTING FACTOR	ON, OFF	Boolean value that determines whether the anti-sooting factor output (A1) will be based linearly on probe temperature (SOOTING FACTOR=ON) or a constant value of 2.0 (SOOTING FACTOR=OFF). If SOOTING FACTOR is ON, a probe temperature of 1408 °F or below limits %C output to 0.75% and 2086 °F or above limits %C output to 2.0%.
PERCENTAGE HYDROGEN	NUMBER, OFF	Number representing $\%H_2$ that is used in the dewpoint calculation.

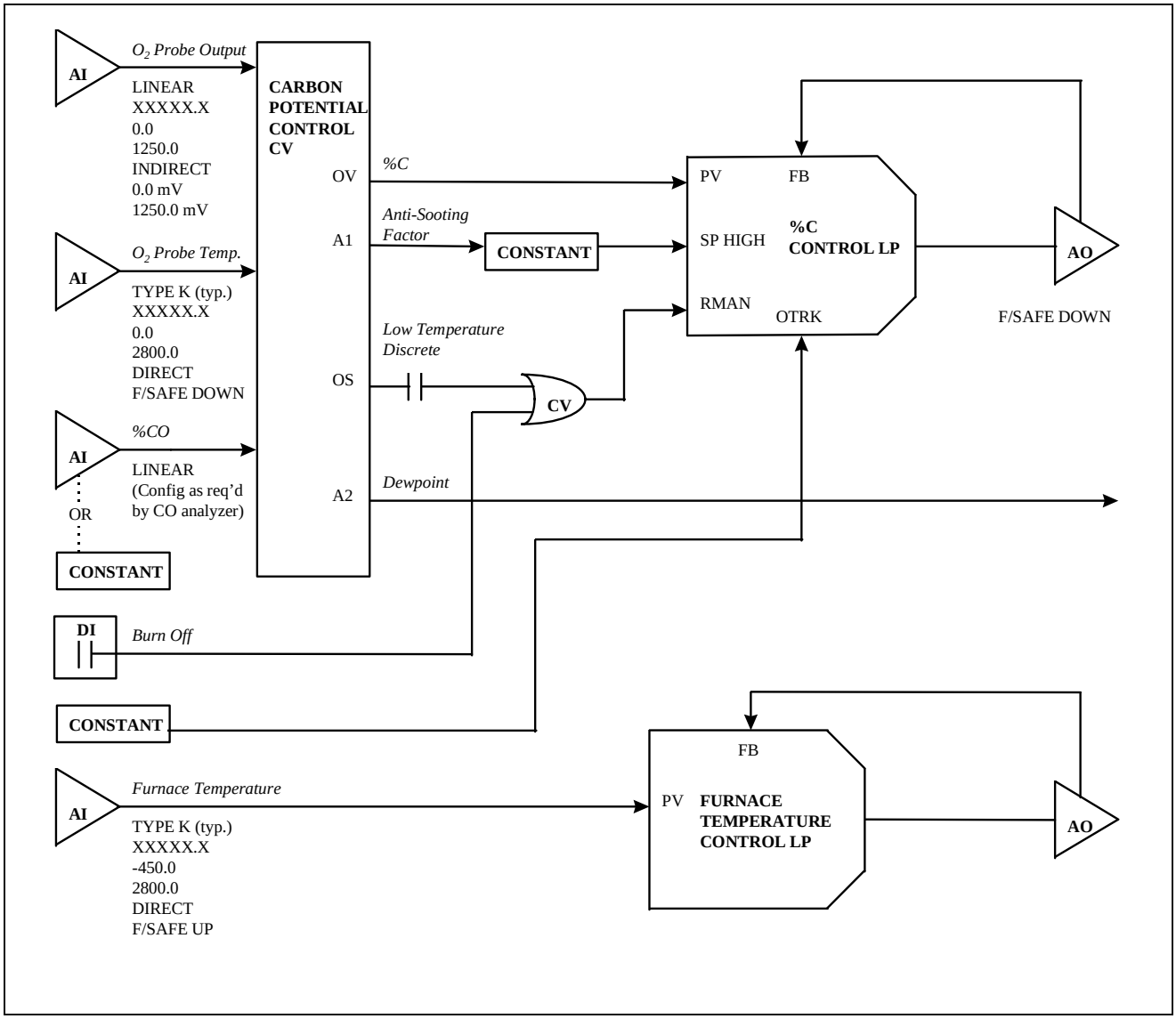


Figure 4-11 Typical Carbon Potential Control Configuration

Relative Humidity

Outputs CVn OV relative humidity as a function of dry-bulb temperature, wet-bulb temperature, and atmospheric pressure.

Table 4-39 describes the Relative Humidity prompts. See Table 4-2 for additional prompts.

Table 4-39 Relative Humidity Prompts

Prompt	Range/Selections	Definition
RANGE LOW	OFF or number	Enter the output's display limits. Output is not clamped or flashed when it exceeds these limits.
RANGE HIGH		
DRY BULB TEMP	OFF, analog parameter, number	Dry bulb temperature in temperature units selected.
WET BULB TEMP	OFF, analog parameter, number	Wet bulb temperature in temperature units selected.
ATM PRESS (PA)	OFF, analog parameter, number	Enter atmospheric pressure in Pascals. 101325 Pa. Is one standard atmosphere.
TEMPERATURE UNITS	F, C, K, R	Select the temperature units for the calculation. Units are for wet bulb and dry bulb.

Sterilization

The output CVn OV is a “kill time”, F_0, which quantifies the destruction of microorganisms during a sterilization process. F_0 represents the number of minutes after which the microorganism population is decreased by one decimal or log unit. The F_0 formula is:

$$F_0 = \sum [dt \times (10^{(T-T_{ref})/Z})]$$

where:

dt = time between F_0 measurements, in minutes. Dt is equal to the scan cycle of the instrument in minutes.

T = measured temperature input, in °C

T_{ref} = reference temperature (121°C typical)

Z = product-dependent temperature constant

This function also compares the calculated F_0 value to the desired F_0 value, F_d (Preset). When F_0 equals or exceeds F_d, the function activates its discrete output CVn OS; this output remains ON(1) until the F_0 calculation is reset via the Reset Input.

The output CVn A2 is the Time Remaining (Tr) at the current temperature to achieve F_d and is calculated as follows:

$$Tr = \frac{(F_d - F_0)}{10^{(T-Tref)/Z}}$$

The F_0 calculation will be reset and the F_0 value will remain at zero while the Reset Input is ON(1). The calculation will resume when the Reset Input goes OFF(0) again.

Table 4-40 describes the Sterilization prompts. See Table 4-2 for additional prompts.

Table 4-40 F_0 Sterilization Prompts

Prompt	Range/Selections	Definition
OUT LOW LIMIT	OFF or number	Displayed output value will be clamped and will flash when these limits are exceeded.
OUT HIGH LIMIT		
RESET	OFF, discrete parameter, 0, 1	Reset input
TEMP INPUT	OFF, analog parameter, number	Measured temperature in degrees C
REFERENCE TEMP	OFF, analog parameter, number	Reference temperature
TEMP CONSTANT	OFF, analog parameter, number	Temperature constant Z
DESIRED F0	OFF, analog parameter, number	Desired F_0 (F_d)

Advanced Splitter Output (ADV SPLITTER)

This function can be used for heat/cool applications. It splits an input into 3 independently scaled outputs: CVn_A1, CVn_A2 and CVn_A3 (Figure 4-12). For each output, when the input is between IN LO LIM and IN HI LIM, the output is scaled between the OUT LO LIM and OUT HI LIM. Each output holds its OUT LO LIM value when the input < the IN LO LIM value for that output. Each output holds its OUT HI LIM value when the input > the IN HI LIM value for that output. Output limits (OUT LO LIM & OUT HI LIM) cannot exceed 100% but can be negatively sloped (OUT HI LIM < OUT LO LIM).

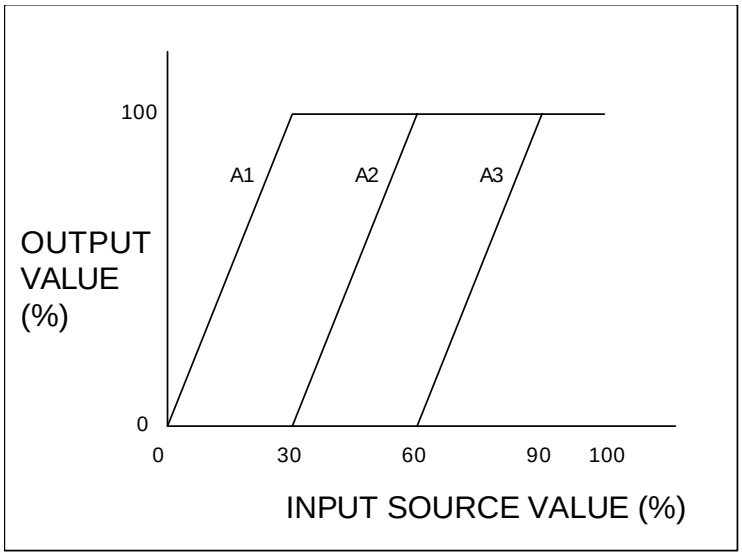


Figure 4-12 Advanced Splitter (Default Outputs)

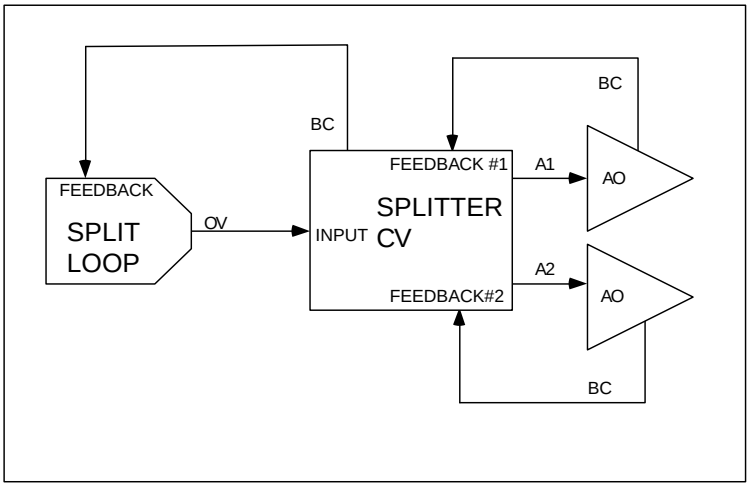


Figure 4-13 Heat/Cool Configuration

Table 4-41 describes the Advanced Splitter prompts. See Table 4-2 for additional prompts.

Table 4-41 Advanced Splitter Prompts

Prompt	Range/Selections	Definition
RANGE LOW	OFF or number	Enter the output's display limits. Output is not clamped or flashed when it exceeds these limits.
RANGE HIGH		
INPUT	OFF, analog parameter, number	Input source. Typically, this is the output value (OV) of a Split Output type of loop.
FEEDBACK #1	OFF, AOn BC, LPn BC	Select the back calculation value (BC) of the analog output assigned to the A1, A2, and A3 outputs, respectively.
FEEDBACK #2		
FEEDBACK #3		
OUT#1 IN LO LIM	OFF or number	Enter a range for A1's input. Defauts are 0 for low limit & 30 for high limit. When input is between these values, A1 output is scaled between OUT#1 OUT LO LIM & OUT#2 OUT HI LIM.
OUT#1 IN HI LIM		
OUT#1 OUT LO LIM	OFF or number	Enter OFF or a range for A1's output. Defaults are 0 for low limit & 100 for high limit. Scales A1 output.
OUT#1 OUT HI LIM		
OUT#2 IN LO LIM	OFF or number	Enter a range for A2's input. Defaults are 30 for low limit & 60 for high limit. When input is between these values, A2 output is scaled between OUT#2 OUT LO LIM & OUT#2 OUT HI LIM.
OUT#2 IN HI LIM		
OUT#2 OUT LO LIM	OFF or number	Enter OFF or a range for A2's output. Defaults are 0 for low limit & 100 for high limit. Scales A2 output.
OUT#2 OUT HI LIM		
OUT#3 IN LO LIM	OFF or number	Enter a range for A3's input. Defaults are 60 for low limit & 90 for high limit. When input is between these values, A3 output is scaled between OUT#3 OUT LO LIM & OUT#3 OUT HI LIM.
OUT#3 IN HI LIM		
OUT#3 OUT LO LIM	OFF or number	Enter OFF or a range for A3's output. Defaults are 0 for low limit & 100 for high limit. Scales A3 output.
OUT#3 OUT HI LIM		

Standard Splitter Output (STD SPLITTER)

This function can be used for heat/cool applications. It is a deadband-based splitter that divides a Split loop's output (-100% to +100%) into two outputs CVn A1 and CVn A2, both of which are zero when the loop output is zero (Figure 4-14). A deadband provides a range of loop output within which both split outputs remain at zero. For overlapped outputs, use Advanced Splitter. Note: A third output CVnA3 is displayed Online and should be ignored.

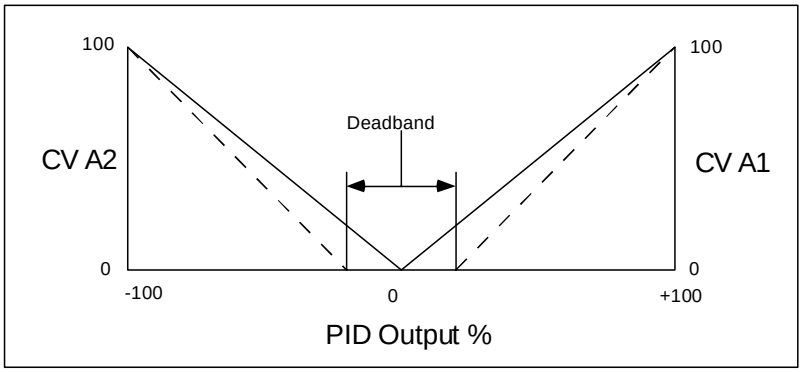


Figure 4-14 Standard Split Output Function

Table 4-42 describes the Standard Splitter prompts. See Table 4-2 for additional prompts.

Table 4-42 Standard Splitter Prompts

Prompt	Range/Selections	Definition
RANGE LOW	OFF or number	Enter the output's display limits. Output is not clamped or flashed when it exceeds these limits.
RANGE HIGH		
INPUT	OFF, analog parameter, number	Input source. Typically, this is the output value (OV) of a Split Output type of loop.
FEEDBACK #1	AOn BC, LPn BC, CVn BC	Enter an AO, LP or CV for the back calculation value (BC) of the analog output assigned to the A1 output.
FEEDBACK #2	AOn BC, LPn BC, CVn BC	Enter an AO, LP or CV for the back calculation value (BC) of the analog output assigned to the A2 output.
OUTPUT DEADBAND	OFF or number	Deadband up to 10% of the input span. In this range, both split outputs will remain at zero.

Scaling

The output CVn OV is a linear scaling of the input using the specified limits.

Table 4-43 describes the Scaling prompts. See Table 4-2 for additional prompts.

Table 4-43 Scaling Prompts

Prompt	Range/Selections	Definition
IN LOW LIMIT	OFF or number	Enter limits of input to be scaled.
IN HIGH LIMIT		
RANGE LOW	OFF or number	Enter the output's scaling values and display limits. Output is not clamped or flashed when it exceeds these limits.
RANGE HIGH		
INPUT	OFF, analog parameter, number	Input to be scaled according to the limits.

Signal Clamp

If input is between Low Select and High Select, the output CVn OV equals the input. If the input exceeds these two limits, the output equals the preset value.

Table 4-44 describes the Signal Clamp prompts. See Table 4-2 for additional prompts.

Table 4-44 Signal Clamp Prompts

Prompt	Range/Selections	Definition
OUT LOW LIMIT	OFF or number	Displayed output value will be clamped and will flash when these limits are exceeded.
OUT HIGH LIMIT		
LOW SELECT	OFF, analog parameter, number	If input goes below this number, the output will equal the preset value. Otherwise, the output equals the input.
HIGH SELECT	OFF, analog parameter, number.	If input goes above this number, the output will equal the preset value. Otherwise, the output equals the input.
INPUT	OFF, analog parameter, number	Input to be clamped.
PRESET	OFF, analog parameter, number.	Output will go to this value when the input exceeds the low or high select values.

1 Point Block Average (1 Pt Block Avg)

Outputs a block mean average CVn OV of the input over the specified Average Period. A new sample of the input will be taken on every instrument scan cycle. The block average is only updated at the end of the Average Period.

When the Reset Input is ON(1) all accumulated samples are discarded and the output is held until the Reset Input is OFF(0), then the averaging period resets.

Table 4-45 describes the 1 Point Block Average prompts. See Table 4-2 for additional prompts.

Table 4-45 1 Point Block Average Prompts

Prompt	Range/Selections	Definition
RANGE LOW	OFF or number	Enter the output's display limits. Output is not clamped or flashed when it exceeds these limits.
RANGE HIGH		
INPUT	OFF, analog parameter, number	This parameter will be averaged.
RESET	OFF, discrete parameter, 0, 1	When the Reset is ON(1) all accumulated samples are discarded and the output is held until the Reset is OFF(0), then the averaging period resets.
AVERAGE PERIOD	0.1 to 1440	Length of averaging period in minutes.

Rolling Average

Outputs a rolling mean average CVn OV of the input over the specified Average Period. As new input samples are collected, old samples are discarded. The function will calculate a new average at equally spaced sample intervals.

$$\text{Sample interval} = \frac{\text{averaging period}}{\text{\# of samples}}$$

$$\text{Rolling Average} = \frac{\text{sum of samples}}{\text{\# of samples}}$$

Example

# of samples = 10

Average Period = 30 minutes

The first average will appear after 30 minutes, then will be updated every 30/10 or 3 minutes after.

When the Reset Input is ON(1) all accumulated samples are discarded and the output is held until the Reset Input is OFF(0), then the averaging period resets.

Table 4-46 describes the Rolling Average prompts. See Table 4-2 for additional prompts.

Table 4-46 Rolling Average Prompts

Prompt	Range/Selections	Definition
RANGE LOW	OFF or number	Enter the output's display limits. Output is not clamped or flashed when it exceeds these limits.
RANGE HIGH		
INPUT	OFF, analog parameter, number	This parameter will be averaged.
RESET	OFF, discrete parameter, 0, 1	Resets average.
# OF SAMPLES	1-60	Number of samples taken during average period.
AVG PERIOD MINS	OFF or number	Number of minutes in average period.

Multiple Input Average (Multiple Avg)

The output CVn A1 is the instantaneous average of the assigned input points. The average is calculated every scan cycle.

Table 4-47 describes the Multiple Average prompts. See Table 4-2 for additional prompts.

Table 4-47 Multiple Average Prompts

Prompt	Range/Selections	Definition
OUT LOW LIMIT	OFF or number	Displayed output value will be clamped and will flash when these limits are exceeded.
OUT HIGH LIMIT		
INPUT #1- INPUT #8	OFF, analog parameter, number	Enter up to 8 inputs to be averaged

CEMS Block Average

Outputs a block mean average CVn OV over the specified Average Period. The average is calculated from input samples taken at equally spaced Sample Periods. All samples are discarded at the end of the Average Period and the Average Period begins again.

Samples are ignored when Calibrate Hold is ON(1). After the Average Period the new average is calculated using only the samples taken before and after the Hold. If no valid samples are taken, the output maintains its previous value.

Table 4-48 describes the CEMS Block Average prompts. See Table 4-2 for additional prompts.

Table 4-48 CEMS Block Average Prompts

Prompt	Range/Selections	Definition
RANGE LOW	OFF or number	Enter the output's display limits. Output is not clamped or flashed when it exceeds these limits.
RANGE HIGH		
INPUT	OFF, analog parameter, number	Input to be averaged
RESET	OFF, discrete parameter, 0, 1	When discrete is ON(1), average is reset to zero; when ON(1)-to-OFF(0), average restarts.
TIME UNITS	SECONDS, MINUTES, HOURS, or DAYS.	Time units of the averaging period
AVERAGE PERIOD	OFF or number	Number of time units per average period.
SAMPLE PERIOD	OFF or number	Number of time units between samples. Must divide evenly into Average Period.
CALIBRATE HOLD	OFF, discrete parameter, 0, 1	When ON(1), no samples are taken and the output is held.

CEMS Rolling Average (CEM Rolling Avg)

Outputs a rolling mean average CVn OV over the specified Average Period. Average is updated every Frame Period thereafter. Samples are taken at every scan cycle of the instrument, except when Calibrate Hold is ON(1).

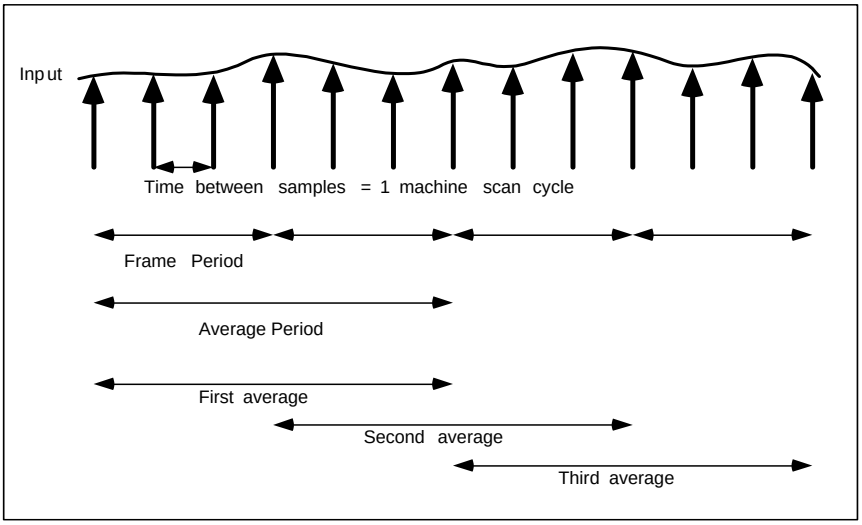


Figure 4-15 CEMS Rolling Average

Table 4-49 describes the CEMS Rolling Average prompts. See Table 4-2 for additional prompts.

Table 4-49 CEMS Rolling Average Prompts

Prompt	Range/Selections	Definition
RANGE LOW	OFF or number	Enter the output's display limits. Output is not clamped or flashed when it exceeds these limits.
RANGE HIGH		
INPUT	OFF, analog parameter, number	Input to be averaged.
RESET	OFF, discrete parameter, 0, 1	When discrete is ON(1), average is reset to zero; when ON(1)-to-OFF(0), average restarts.
TIME UNITS	Seconds, minutes, hours, or days.	Time units of the averaging period.
AVERAGE PERIOD	OFF or number	Number of time units per average period.
FRAME PERIOD	OFF or number	Number of time units per Frame Period. Must divide evenly into Average Period.
CALIBRATE HOLD	OFF, discrete parameter, 0, 1	When ON(1), no samples are taken and the output is held. If calibrate hold is set ON, the function block stops acquiring samples; however, the averaging will continue to update for the remainder of the average period, after which, the output value will hold. If calibrate hold is set ON longer than the average period, the display will alternate between the last output value and *****(indicating the current value is no longer valid). If calibrate hold is set OFF and the CEM Rolling Average is **not reset**, the CEM Rolling Average will continue to update every frame period from the last value. If the CEM Rolling Average **is reset**, the average value is set to zero and the displayed value will not update until the Average period has transpired. The average value will update every frame period.

4.13 Program Alarms

You can program an alarm to be triggered by any extreme input value. To program alarms, select "PROGRAM ALARMS" on the Main Program Menu. Select an alarm to program.

REFERENCE

When an alarm occurs, it produces an output pulse which can be configured to trigger a discrete output (such as a relay). Refer to Section 4.11 for instructions.

Table 4-50 describes the Alarm prompts. See Table 4-2 for additional prompts.

Table 4-50 Alarm Prompts

Prompt	Range/Selections	Definition
ON STATE	See Table 4-3 for choices.	Enter labels for on and off states of alarm
OFF STATE		
ALARM ACTION	HIGH	Alarm when input value ≥ set point value.
	LOW	Alarm when input value ≤ set point value.
	DEV	Deviation. Alarm when input value deviates above or below compare point value by an amount ≥ set point value.
	HDEV	High deviation
	LDEV	Low deviation
	HRATE	High Rate. Alarm when input value increases at rate ≥ set point value, in units per minute. Negative rate set points are processed as positive values. May take up to 30 seconds to activate.
	LRATE	Low Rate. Alarm when input value decreases at rate ≥ set point value, in units per minute. Negative rate set points are processed as positive values. May take up to 30 seconds to activate.
	NONE	No alarm action.
INPUT	OFF, analog parameter, number	Input source monitored by alarm.
SETPOINT	OFF, analog parameter, number	Point at which alarm occurs.
COMPARE POINT	OFF, analog parameter, number	DEV type only. It is the point against which the input point is compared. The difference between the input point and the compare point is the value which is measured against the alarm set point.
HYSTERESIS	OFF or number	Hysteresis affects only the point at which an alarm clears. A high alarm will clear when the input is less than the set point minus the hysteresis value. A low alarm will clear when the input is greater than the set point plus the hysteresis value. A deviation alarm will clear when the input is less than the set point minus the hysteresis value.
DELAY TIME	OFF or number	If the alarm condition clears before the delay time (in seconds) expires, no alarm will be indicated. Delay time must be in multiples of scan time.
SAMPLE HOLD	OFF, discrete parameter, 0 or 1	When this parameter level = 1, the alarm processing is disable and the output is held.

4.14 Program Totalizers

The optional totalizer integrates an analog value over time. With the input being viewed as a flow rate, the function outputs a running total TLn OV over time.

ATTENTION

Totalizers which exceed the value 999,999 may only be displayed on the dedicated “Totalizer Display”. If the value is programmed on other displays or stored to disk, when it exceeds the programmed limits the value may be truncated and the value will flash.

Select a Totalizer to program. Table 4-51 describes the Totalizer prompts. See Table 4-2 for additional prompts.

Table 4-51 Totalizer Prompts

Prompt	Range/Selections	Definition
INPUT SOURCE	OFF, analog parameter, number.	Input source to be totalized.
OUTPUT LOW LIMIT	OFF or number	The range outside which the displayed output will flash unclamped. Useful for warning operator of unusual condition.
OUTPUT HIGH LIMIT		
ACTION	UP	At each machine scan cycle, an integration of the input is added to the running total. When this total reaches or exceeds the preset value (assumed to be in eng. Units), the discrete output of the totalizer goes high and remains high for 1 scan cycle. The totalizer then resets and starts again. The value resets to either zero or the residual total (final total minus preset) if one exists.
	DOWN	At each machine scan cycle, an integration of the input is subtracted from the preset value. When this result reaches or goes below zero, the discrete output of the totalizer goes high and remains high for 1 scan cycle. The totalizer then resets and starts again. The value resets to either the preset or the residual total (preset plus final total [since final total is either zero or negative]) if one exists.
	DEMAND	On Demand. Same as UP, except executes only while the ON DEMAND INPUT discrete is ON(1). Input is ignored while ON DEMAND INPUT is OFF(0).
	CONTIN	Continuous. Same as UP except the total ignores the PRESET value and integrates “forever” (continuously).
TIME UNITS	SEC, MIN, HOUR, DAY	Time units of the totalizer
ON DEMAND INPUT	OFF, discrete parameter, 0, 1	Appears for Functions as the On Demand input for the DEMAND action. Activates totalizer when ON(1).
PRESET	OFF, analog parameter, number	Up totalizer counts up to this value. Down totalizer counts down from this value.
ZERO CUTOFF	OFF or number	Represents the least value to be accumulated in the totalizer. Input values below this value will be input as zero.
RESETTABLE	YES, NO	If NO, the Totalizer is non-resettable and cannot be reset via the operator keypad. This setting does not affect the action of the reset discrete parameter.
RESET	OFF, discrete parameter, 0, 1.	When the RESET goes high (1) an UP action totalizer will reset to zero, or a DOWN action totalizer will reset to the preset value. Use SY1 F3 to reset with the RESET or F3 key.

4.15 Program Profiles

Profile programming is explained in Section 5.

4.16 Program Constants

Constants can be programmed here and their values edited Online. Select a constant to program.

Table 4-52 describes the Constant prompts. See Table 4-2 for additional prompts.

Table 4-52 Constant Prompts

Prompt	Range/Selections	Definition
VALUE	OFF, analog parameter, number	If a number, the Constant may be altered Online from the Data Entry menu. If a parameter, this parameter can be directed by DESTINATION to override certain programmed values.
INPUT LOW LIMIT	OFF or number	Display limits (for when viewing Constant on trend display or on bar displays).
INPUT HIGH LIMIT		
DESTINATION		See Destination defined on next page.
	NONE	No destination
	LP*n* GN	LOOP*n* GAIN1
	LP*n* PB	LOOP*n* PROP. BAND #1
	LP*n* RS	LOOP*n* RESET #1
	LP*n* RA	LOOP*n* RATE #1
	LP*n* RB	LOOPn RATIO BIAS
	LP*n* IS	LOOP*n* SP INC SLEW LIMIT
	LP*n* DS	LOOP*n* SP DEC SLEW LIMIT
	LP*n* HS	LOOP*n* SP HIGH LIMIT
	LP*n* LS	LOOP*n* SP LOW LIMIT
	AO*n* IS	AO*n* INC SLEW LIMIT
	AO*n* DS	AO*n* DEC SLEW LIMIT
	AO*n* HS	AO*n* IN HIGH LIMIT
	AO*n* LS	AO*n* IN LOW LIMIT
	AO*n* IT	AO*n* IMPULSE TIME (type DAT)
COMM CONSTANT	Yes/No	When enabled, any constant writes via modbus communication will only be written to the RAM copy of the configuration and not to the non volatile flash copy. When the unit cold starts, the constant values set up to be periodically written via communications will revert back to any value that was manually set via the local HMI. The local HMI will always write the constant value to the RAM and non volatile flash which will be preserved across a power cycle.

Destination defined

To program Loops and Analog Outputs, you select the Program Control Loops or Program Analog Outputs from the Program Mode Menu, then program each menu item. Some of these menu items, such as proportional band or slew limits, are function block parameters; that is, they can be programmed with numerical values only. A Constant's DESTINATION overrides that numerical value with a live value (variable) provided by the Constant's VALUE.

For example, suppose Loop1's Gain #1 is programmed as the number 5.00, and Constant 1's Value is CV 1 OV, the output of Calculated Value #2. By programming Constant1's Destination as LP1GN, Loop1's Gain #1 will no longer be 5.00 but will be continuously updated by the live value provided by CV 1 OV.

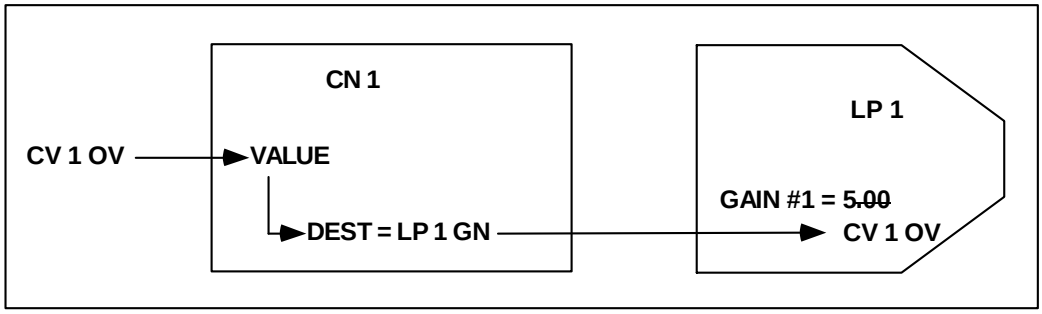


Figure 4-16 Example of Constant Destination

IMPORTANT

Always be certain that the destination is compatible with its associated loop or analog output. A mismatched destination can affect your output and can be difficult to diagnose. Examples: If destination is AO1 IT (impulse time), be sure that AO1 is programmed as a DAT. If destination is LP2 IS, be sure that Loop #2 is a type that has increased slew limit on its menu.

ATTENTION

- If the destination is used, the parameter being overridden by the destination cannot be accessed or changed. For example, Loop Gain cannot be tuned Online in the TUNE LOOP menu.

- If you reprogram destination to another parameter or NONE, the original destination parameter maintains its last live value as determined by the constant's value. If you want the destination's last live value to be zero or NONE:

    1. change the constant value to zero or NONE,
    2. change to Online mode for 5 seconds to override the previous live value with zero or NONE,
    3. change back to program mode,
    4. re-program constant's destination to NONE.

- If you program multiple constants with the same destination, only the highest numbered constant's destination takes effect. For example, if Constant #1 and Constant #5 both have destination = AO2 IT, then only Constant #5's value is used by AO2 IT.

4.17 Copy Block

Use Copy Block to copy the setup of any function block to another channel of the same function block. For example, if you have programmed AI1 and want AI2 to have the same settings, use Copy Block. If desired, you can make program changes to AI2 after the copy is complete.

If your instrument can run multiple profiles at the same time, Copy Block is useful for copying the parameters of one profile to another. For example, if your instrument can run 2 profiles, it may be useful to have both profiles use the same switches for starting, holding, and resetting. After you program the first profile's parameters, use Copy Block to copy Profile #1 to Profile #2.

Table 4-53 describes the Copy Block prompts.

Table 4-53 Copy Block Prompts

Prompt	Range/Selections	Definition
BLOCK TYPE	AI, AO, AL, CN, CV, DI, DO, LP, TL, SP	Select the function block type to be copied. AI: Analog Input AO: Analog Output AL: Alarm CN: Constant CV: Calculated Value DI: Discrete Input DO: Discrete Output LP: Control Loop SP: Set point Profile TL: Totalizer
FROM NUMBER	NUMBER	Enter the channel number to be copied.
TO NUMBER	NUMBER	Enter a channel to copy to or "ALL" if you want to copy this block to all other channels.
COPY BLOCK		Select this to do the copy. A verification prompt lets you continue or abort the copy.

4.18 Program Displays

You can configure up to 10 primary displays using one or more display formats shown in Figure 4-17and assign them to appear in specified order when the Display button is pressed.

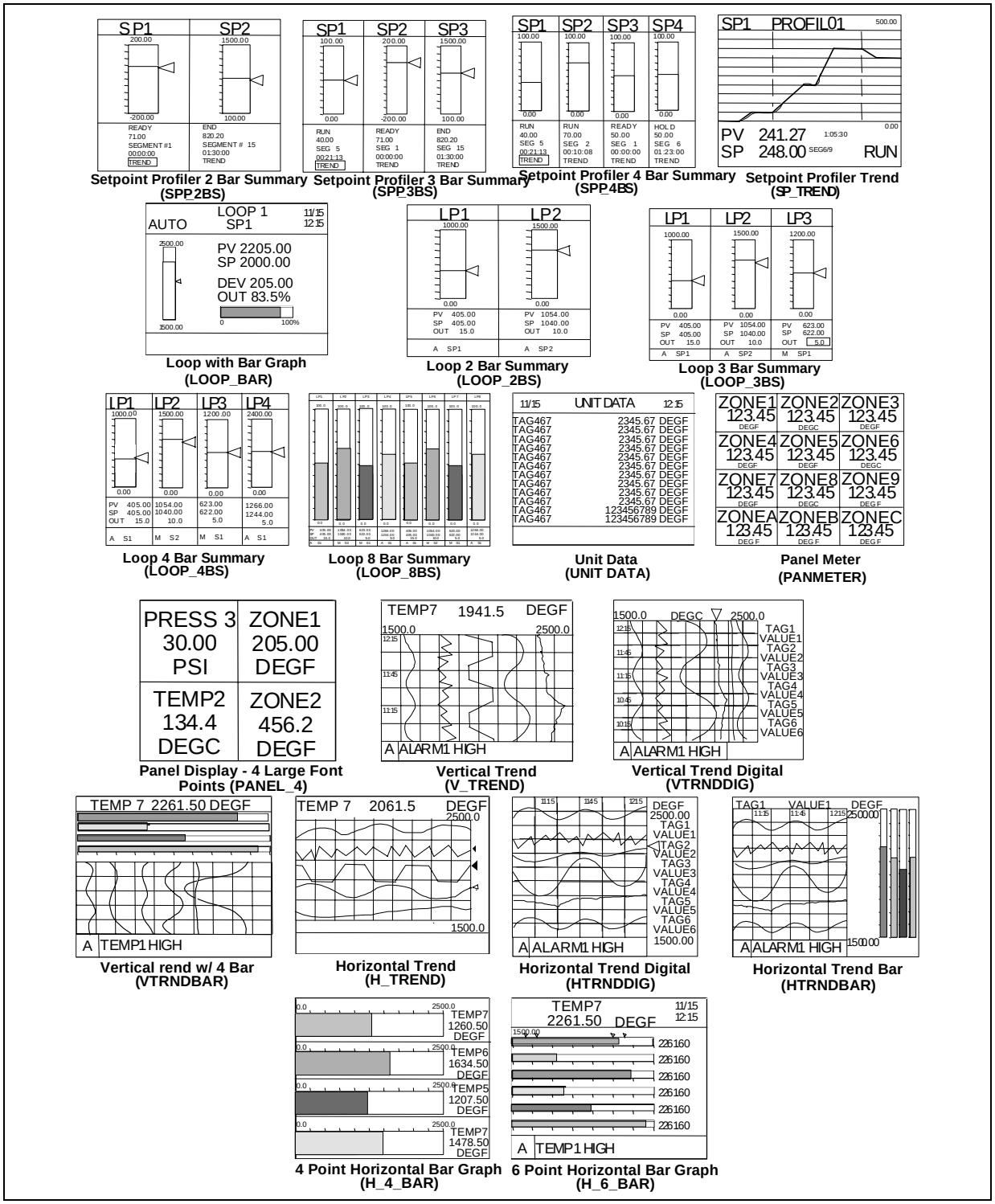


Figure 4-17 Displays Accessible by the Display Buttons (continued)

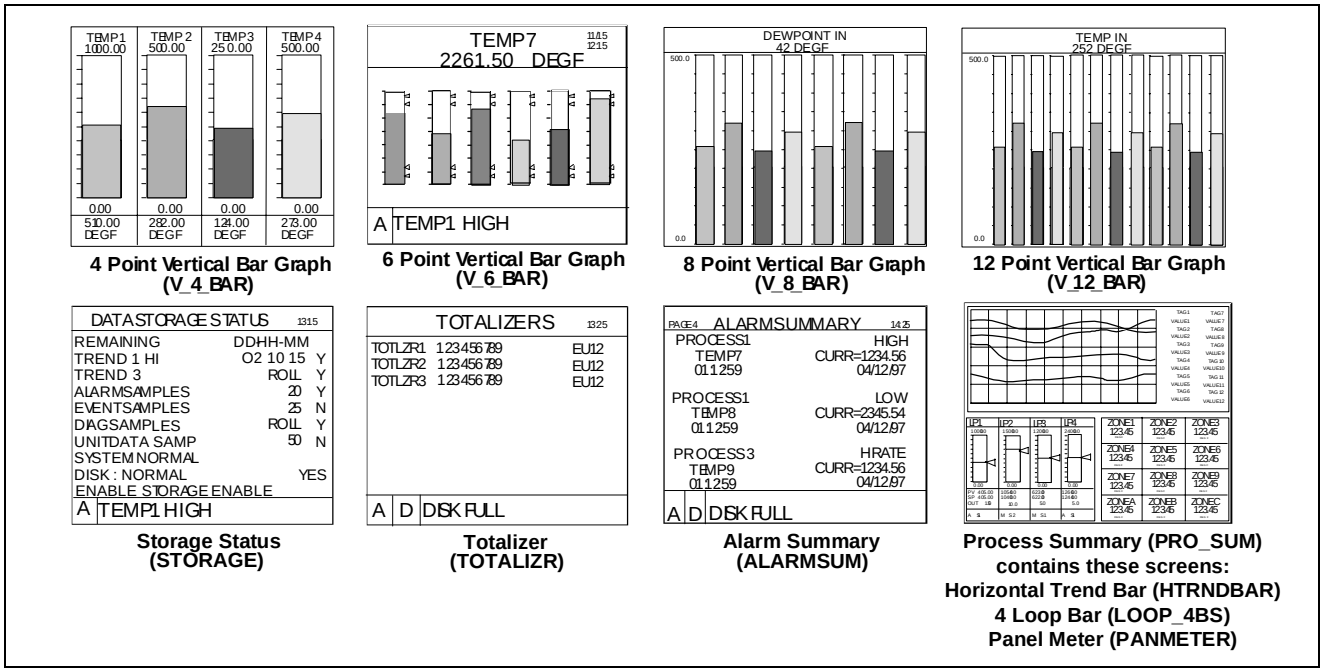


Figure 4-17 Displays Accessible by the Display Buttons

Display Setup Procedure

Table 4-54 describes the display setup procedure.

Table 4-54 Display Setup Procedure

Step	Action
1	Select Program Displays from the Program mode menu.
2	For each display format desired (trend, bar graph, panel display, unit data), specify points to be displayed.
3	Assign up to 10 displays to the Display buttons.

Set Up Trend 1

Table 4-55 describes the trend display setup procedure.

Table 4-55 Set Up Trend 1 Prompts

Prompt	Range/Selections	Definition
ENABLE	Yes, No	Enables or disables a specific trend.
POINT #1 POINT #12	Analog or discrete parameters	Select up to 12 analog or discrete points to be displayed as a vertical or horizontal trend. Trends of discrete points will show a value of 1 when ON and 0 when OFF.
NORM TIME BASE	5, 15, or 30 minutes, or 1, 2, 4, 8, 24 hours, 7 days or 31 days. Equivalent paper chart speeds are listed in Table 4-56.	Enter the trend display time base for Normal (typically slow speed). The time base is the time period shown for one full screen.
ALT TIME BASE	5, 15, or 30 minutes, or 1, 2, 4, 8, 24 hours, 7 days or 31 days. Equivalent paper chart speeds are listed in Table 4-56.	Enter the trend display time base for Alternate (typically fast speed). The time base is the time period shown for one full screen.
SET DISPLAY LIMITS	OFF or number	Set the high and low full-scale display limits for each point. If you select OFF for a limit on this display, the limits programmed for the analog point (either RANGE LOW and RANGE HIGH or OUT LOW LIMIT and OUT HIGH LIMIT) will be used as the trend limits for that point. The accuracy of a trended point is determined only by the original output limits of the point, not by setting wider or narrower limits here. Setting excessively narrower limits here will result in a viewable trend with a high degree of inaccuracy when viewed as a % of the screen. To increase accuracy over a narrower range, decrease the programmed output range (limits) of the point itself.
TIMEBASE SELECTOR	OFF, discrete parameter, 0, 1	Enter a discrete parameter which will cause trend to display alternate timebase when ON and normal timebase when OFF.

Table 4-56 Paper Chart Speed Equivalents to Time Base Selections

Instrument Time/Screen	Paper Chart Vertical Trend cm/hour *(inches/hour)*	Paper Chart Horizontal Trend cm/hour *(inches/hour)*
5 minutes	154 *(60.6)*	246 *(96.8)*
15 minutes	51.3 *(20.2)*	82 *(32.2)*
30 minutes	25.6 *(10.1)*	41 *(16.2)*
1 hour	12.8 *(5.1)*	20.5 *(8.1)*
2 hours	6.9 *(2.7)*	10.25 *(4.0)*
4 hours	3.4 *(1.34)*	5.1 *(2.0)*
8 hours	1.6 *(0.63)*	2.56 *(1.0)*
24 hours	0.53 *(0.21)*	0.85 *(0.33)*
7 days	0.076 *(0.03)*	0.122 *(0.048)*
31 days	0.017 *(0.007)*	0.027 *(0.011)*

Set Up Trend 2 - 3 - 4

See Table 4-55 for prompts. For Point #1 - Point #12, enter a second group of up to 12 points that will be displayed as a horizontal or vertical trend.

Log scale trending

This feature enables trending of logarithmic trending on the video chart. This feature is enabled by the following rules :

1. Programming the decimal point for trend point #1 as X.XXEXX and then trend point #1 and any subsequent trend point that also has X.XXEXX as the decimal point will be plotted logarithmically with the number of log divisions derived automatically from the low and high limit of point #1.
2. Setting up the trend display limits decimal position to be X.XXEXX and then any trend point that also has X.XXEXX as its decimal position will be plotted logarithmically with the number of log divisions derived automatically from the low and high of the first trend point found with X.XXEXX decimal position.

Live Trend Buffer Size

Table 4-57 1 trend group live buffer size

1 Trend Group									
Number of points in the trend	*Number of pages in the buffer*	*Display length*							
		5 min	*15 min*	*30 min*	*1 hr*	*2 hrs*	*4 hrs*	*8 hrs*	*24 hrs*
1	634	52,9	158,6	317,1	634,2	1 268,4	2 536,9	5 073,8	15 221,3
2	423	35,2	105,7	211,4	422,8	845,6	1 691,3	3 382,5	10 147,5
3	317	26,4	79,3	158,6	317,1	634,2	1 268,4	2 536,9	7 610,6
4	254	21,1	63,4	126,8	253,7	507,4	1 014,3	2 029,5	6 088,5
5	211	17,6	52,9	105,7	211,4	422,8	845,6	1 691,3	5 073,8
6	181	15,1	45,3	90,6	181,2	362,4	724,8	1 449,6	4 348,9
7	159	13,2	39,6	79,3	158,6	317,1	634,2	1 268,4	3 805,3
8	141	11,7	35,2	70,5	140,9	281,9	563,8	1 127,5	3 382,5
9	127	10,6	31,7	63,4	126,8	253,7	507,4	1 014,8	3 044,3
10	115	9,6	28,8	57,7	115,3	230,6	461,3	922,5	2 767,5
11	106	8,8	26,4	52,9	105,7	211,4	422,8	845,6	2 536,9
12	98	8,1	24,4	48,8	97,6	195,1	390,3	780,6	2 341,7
		Buffer Size in hours							

Table 4-58 2 trend group live buffer size

2 Trend Groups									
Number of points in the trend	*Number of pages in the buffer*	*Display length*							
		5 min	*15 min*	*30 min*	*1 hr*	*2 hrs*	*4 hrs*	*8 hrs*	*24 hrs*
1	317	26,4	79,3	158,6	317,1	634,2	1 268,4	2 536,9	7 610,6
2	211	17,6	52,9	105,7	211,4	422,8	845,6	1 691,3	5 073,8
3	159	13,2	39,6	79,3	158,6	317,1	634,2	1 268,4	3 805,3
4	127	10,6	31,7	63,4	126,8	253,7	507,4	1 014,8	3 044,3
5	106	8,8	26,4	52,9	105,7	211,4	422,8	845,6	2 536,9
6	91	7,6	22,7	45,3	90,6	181,2	362,4	724,8	2 174,5
7	79	6,6	19,8	39,6	79,3	158,6	317,1	634,2	1 902,7
8	70	5,9	17,6	35,2	70,5	140,9	281,9	563,8	1 691,3
9	63	5,3	15,9	31,7	63,4	126,8	253,7	507,4	1 522,1
10	58	4,8	14,4	28,8	57,7	115,3	230,6	461,3	1 383,8
11	53	4,4	13,2	26,4	52,9	105,7	211,4	422,8	1 268,4
12	49	4,1	12,2	24,4	48,8	97,6	195,1	390,3	1 170,9
		Buffer Size in hours							

Table 4-59 4 trend group live buffer size

4 Trend Groups									
Number of points in the trend	*Number of pages in the buffer*	*Display length*							
		5 min	*15 min*	*30 min*	*1 hr*	*2 hrs*	*4 hrs*	*8 hrs*	*24 hrs*
1	159	13,2	39,6	79,3	158,6	317,1	634,2	1 268,4	3 805,3
2	106	8,8	26,4	52,9	105,7	211,4	422,8	845,6	2 536,9
3	79	6,6	19,8	39,6	79,3	158,6	317,1	634,2	1 902,7
4	63	5,3	15,9	31,7	63,4	126,8	253,7	507,4	1 522,1
5	53	4,4	13,2	26,4	52,9	105,7	211,4	422,8	1 268,4
6	45	3,8	11,3	22,7	45,3	90,6	181,2	362,4	1 087,2
7	40	3,3	9,9	19,8	39,6	79,3	158,6	317,1	951,3
8	35	2,9	8,8	17,6	35,2	70,5	140,9	281,9	845,6
9	32	2,6	7,9	15,9	31,7	63,4	126,8	253,7	761,1
10	29	2,4	7,2	14,4	28,8	57,7	115,3	230,6	691,9
11	26	2,2	6,6	13,2	26,4	52,9	105,7	211,4	634,2
12	24	2,0	6,1	12,2	24,4	48,8	97,6	195,1	585,4
		Buffer Size in hours							

Set Up Bar Graph 1

Table 4-60 describes the prompts for setting up Bar Graph 1.

Table 4-60 Set Up Bar Graph 1 Prompts

Prompt	Range/Selections	Definition
POINT #1 – POINT #12	OFF, analog parameter, numbers	Select up to 12 analog points, each to be displayed as a vertical or horizontal bar graph.

Set Up Bar Graph 2 - 3 - 4

See Table 4-60 for prompts. For Point #1 - Point #12, enter a second group of up to 12 points that will be displayed as horizontal or vertical bar graphs.

Set Up Panel Displays

Table 4-61 describes the prompts for setting up a Panel Display and Panel Meter Display.

Table 4-61 Set Up Panel Display Prompts

Prompt	Range/Selections	Definition
POINT #1-POINT #12	Analog or discrete parameters	Select up to 12 analog or discrete points. On the Panel_4 Display, these points will be displayed four at a time at a specified rotation rate and can be seen from 15 feet (5 meters). On a panel meter display, these 12 points will be displayed all at once.

Set Up Unit Data Display

Table 4-62 describes the prompts for setting up a Unit Data Display.

Table 4-62 Set Up Unit Data Display Prompts

Prompt	Range/Selections	Definition
POINT #1- POINT #12	Analog or discrete parameters	Select up to 12 analog or discrete points. These points will be displayed as a list.

Set Up Profile Displays

Table 4-63 describes the prompts for setting up a Profile display. Affects the Set point Profiler Trend displays only.

Table 4-63 Set Up Profile Display Prompts

Prompt	Range/Selections	Definition
PROFILE #1 PROFILE #2 PROFILE #3 PROFILE #4		Select a profile display to set up.
DISPLAY TIME	Number	Enter the time width of the profile trend display, in the time units of the profile. The higher this number, the more of a profile will fit on the screen at a time. A value of zero means the entire profile will be displayed, if the profile has no infinite segment loops, no infinite auto cycling, and no external ramp type.

Assign Displays to Keys

Your instrument has 4 display keys. You can assign a total of 10 displays to these keys. Pressing the Display 1 key (1) accesses the format you assign to Display 1. Display 2 key (2) accesses Display 2 and Display 3 key (3) accesses Display 3. The Display key ( ) accesses displays 4-10.

Table 4-64 describes the prompts for assigning displays to keys.

Table 4-64 Assign Displays To Keys Prompts

Prompt	Range/Selections	Definition
BLANKING TIME	OFF, 1 HOUR, 30 MIN, 15 MIN, 5 MIN, 1MIN	This is a screen-saver type function. If enabled, the screen will blank after time selected. Screen will unblank if a key is pressed or an alarm/diagnostic occurs.
DISPLAY KEY	0, 1, OFF, PARM	By selecting PARM, you can connect a discrete input parameter which will function as the Display key. Each off-to-on transition of this discrete will behave as if the Display key were pressed. Select 0, 1, or OFF to disable this function.
BACKGROUND COLOR	WHITE, BLACK	This sets the background color of displays to black or white. Affects all Trend (live and replay), Bar Graph, and Panel displays. Does not affect Loop, Unit Data, Summary, or menus.
SELECT PEN COLOR	PEN #1 PEN #2 . . . PEN #12	Assign a color to each of up to 12 points. Affects points displayed on all Trend (live and replay), Bar Graph, Loop, and Panel displays. Pen #1 corresponds to Point #1, Pen #2 corresponds to Point #2, etc. Choices: Green, Cyan, Yellow, Purple, Blue, Brown, Red, Black, White. Attention: A Yellow pen appears yellow on a black background and orange on a white background. Caution: Do not select a white pen color for a white background or a black pen color on a black background; these will render your points invisible.

(continued)

Table 4-64 Assign Displays To Keys Prompts (continued)

Prompt	Range/Selections	Definition
DISPLAY 1 DISPLAY 2 . . . DISPLAY 10	FORMAT	Select one of the following display formats. The corresponding format will be shown when the Display keys are pressed. V_TREND (Vertical Trend) VTRNDDIG (Vertical Trend Digital) VTRNDBAR (Vertical Trend Bar) VT_6DIV (Vertical Trend-6 Division) H_TREND (Horizontal Trend) HTRNDDIG (Horizontal Trend Digital) HTRNDBAR (Horizontal Trend Bar) V_4_BAR (4-Point Vertical Bar Graph) V_6_BAR (6-Point Vertical Bar Graph) V_8_BAR (8-Point Vertical Bar Graph) V_12_BAR (12-Point Vertical Bar Graph) H_4_BAR (4-Point Horizontal Bar Graph) H_6_BAR (6-Point Horizontal Bar Graph) PANEL_4 (4-Point Panel Display) UNIT DATA (Unit Data Display) PANMETER (Panel Meter) ALARMSUM (Alarm Summary) STORAGE (Storage Status) TOTAL (Display 1 totalizer) TOTALIZR (Display all totalizers) LOOP_BAR (Loop with Bar Graph) LOOP_2BS (Loop with 2 Bar Graphs) LOOP_3BS (Loop with 3 Bar Graphs) LOOP_4BS (Loop 4 Bar Summary) LOOP_8BS (Loop 8 Bar Summary) SPP_2BS (Set point Profiles with 2 Bar Graphs) SPP_3BS (Set point Profiles with 3 Bar Graphs) SPP_4BS (Set point Profiles with 4 Bar Graphs) SP_TREND (Set point Profile Trend) PROSUM (Process Summary)
	TREND	Appears if a trend format is selected. Select trend data to be displayed: TREND 1, TREND 2, TREND 3 or TREND 4
	BARGRAPH	Appears if a bar graph format is selected. Select bar graph data to be displayed: BARGRAPH 1, BARGRAPH 2, BARGRAPH 3 or BARGRAPH 4
	ROTATION RATE	Appears if trend, panel ,display or some bar formats are selected. Select number of seconds each point on the panel display will be shown: 1, 2, 3, 4, 5, 10, 15, 20, 30, 40, 50, 60
	LOOP	Appears if a loop format is selected. Select loop to be displayed.
	PROFILE	Appears if Set point Profile Trend format is selected. Select profile to be displayed.

4.19 Enable Features

Features can be restored to or removed from menus and displays simply by turning them On (ENABLE) or Off (DISABLE) here. Disabled functions and their data are not destroyed or erased—they just cannot be viewed on the display. For example, a programmed constant retains its value and continues to function in calculations whether it is disabled or enabled.

Table 4-65 Enable Features Prompts

Prompt	Range/Selections	Definition
EXPANDED INPUT	ENABLE, DISABLE	DISABLE removes the LAG and SAMPLE/HOLD functions from the Analog Input Programming menu.
PYROMETRY	ENABLE, DISABLE	DISABLE removes all the Rayotube and Spectray ranges from the list of types on the Program Analog Input menu.
AI VALUE ADJUST	ENABLE, DISABLE	DISABLE removes the ANALOG INPUT ADJUST from the Online Data Entry menu, which disables the ability to apply adjust or emissivity corrections.
DI/DO FORCING	ENABLE, DISABLE	DISABLE removes the FORCE DI/DO POINTS from the Online Data Entry menu, which removes the ability to force any DI/DO on or off.
ALARMS	ENABLE, DISABLE	DISABLE removes access to the entire alarm system. Any alarms already programmed will still operate, giving message stripes and operating relays. There will be no alarm summary or related displays.
CONSTANTS	ENABLE, DISABLE	DISABLE removes the Constant entry display, thus removing the ability to set or adjust CN values. CNs previously programmed will continue to exist.
LABELING	ENABLE, DISABLE	DISABLE removes the labeling prompts from the individual parameter programming submenus. Labeling can still be entered from the “ENTER LABELS” item on the main Program menu.
REVIEW PROGRAM	ENABLE, DISABLE	DISABLE removes the REVIEW PROGRAMMING function from the main Online menu.
DISK REPLAY	ENABLE, DISABLE	DISABLE removes the menu items which allow access to the Online retrieval of stored data.
ZOOM	ENABLE, DISABLE	DISABLE removes the menu items which allow access to the Online trend Zoom feature.
POINT DETAIL	ENABLE, DISABLE	DISABLE removes the menu items which allow access to the Online trend Point Detail feature.
TIMEBASE SELECT	ENABLE, DISABLE	DISABLE removes the menu items which allow access to the manual Trend Timebase Select capability.
CUSTOM INPUT	ENABLE, DISABLE	DISABLE removes INPUT ALGORITHM prompt from the Program Analog Input menu.

4.20 Program Security

Security lets you protect certain menu items and functions from unwanted or accidental access. Access to a secured item requires entry of a 3-digit master or operator code.

Select "PROGRAM SECURITY" to display the Security menu (if security is active, you will be prompted to enter the master code before continuing).

REFERENCE

If the master or operator's security code is lost or forgotten, a security bypass procedure is available. See Appendix A.

Table 4-66 describes the Security prompts.

Table 4-66 Security Prompts

Prompt	Range/Selections	Definition
ENABLE SECURITY	YES, NO	Set to Yes to activate security on all enabled security items having a non-zero master or operator's code. *If set to No, no items will be secure!*
MASTER SEC CODE	3 digit number	Set to a non-zero value; a value of zero offers no security. Secures the following items: MEMORY CLEAR SERVICES in Maintenance mode. PROGRAM SECURITY in Program mode Changing out of Online Mode. (See SET MODE.)
	SET MODE	Set to Yes to secure changing from Online mode to Program or Maintenance modes.
OPERATOR SEC CODE	3 digit number	Enter a non-zero operator security code value; a value of zero offers no security. Secures the following items (if set to Yes).
	AUTO/MANUAL	Set to Yes to secure Online changes between a loop's Auto and Manual modes.
	SP1/SP2	Set to Yes to secure Online changes between a loop's SP1 and SP2.
	SETUP PARAMETERS	Set to Yes to secure changes to: • Online Data Entry menu items: Alarm Set points Analog Input Adjust • Online Tune Loop menu
	REVIEW PROGRAM	Set to Yes to secure Online access to Review Programming (via REVIEW PROGRAMMING menu).
	DATA STORAGE	Set to Yes to secure access to any part of data storage (via Online DATA STORAGE SETUP menu). Does not affect access to Online DATA STORAGE STATUS display.
	PROFILER	Set to Yes to secure access to all Set point Profiler menus and displays.

4.21 Serial Communications

Serial Communications is an optional feature that lets the instrument exchange data with a host device (a PC running Honeywell or other compatible software) on an RS422/485 data link. Using Modbus RTU protocol, this link can be used to transfer configurations and data. Set up the link as follows.

Table 4-67 describes the Serial Communications prompts.

Table 4-67 Serial Communications Prompts

<table>
<tr><th>Prompt</th><th>Range/Selections</th><th colspan="3">Definition</th></tr>
<tr><td>UNIT ADDRESS</td><td>1-254</td><td colspan="3">Enter the unit's address. Use a number once only so that each address on the link is unique.</td></tr>
<tr><td>BAUD RATE</td><td>1200, 2400, 4800, 9600, 19200, 38400, 76800.</td><td colspan="3">Enter the speed of data transfer. All equipment on the link must be set to match the host setting.</td></tr>
<tr><td>DOWNLOAD LOCKOUT</td><td>YES, NO</td><td colspan="3">Set to YES to prevent configurations from being downloaded from a PC with SCF software.</td></tr>
<tr><td rowspan="6">BYTE ORDER</td><td rowspan="6">FP_B : Big Endian
FP_BB : Big Endian with Byte swap
FP_L : Little Endian
FP_LB : Little Endian with Byte swap</td><td colspan="3">This feature allows a user to select the byte order for a floating point register.

Example for 25.38 :</td></tr>
<tr><td></td><td>Byte order</td><td>Result</td></tr>
<tr><td>FP_B</td><td>0123</td><td>41CB0A3D</td></tr>
<tr><td>FP_BB</td><td>1032</td><td>CB413D0A</td></tr>
<tr><td>FP_L</td><td>3210</td><td>3D0ACB41</td></tr>
<tr><td>FP_LB</td><td>2301</td><td>0A3D41CB</td></tr>
</table>

4.22 Set Clock

To assure data, alarms, and events are properly time stamped, the clock must be properly set. The clock uses military time.

Select "CLOCK" from the main Program menu. Enter the date and time with the following prompts.

Table 4-68 describes the Set Clock prompts.

Table 4-68 Set Clock Prompts

Prompt	Range/Selections	Definition
MONTH	JAN - DEC	Enter the date and time.
DAY	1-31	
YEAR	Enter year	
HOURS	0-23	
MINUTE	0-59	
FORMAT	USA = MMDDYY INTL = DDMMYY	Select clock format.

IMPORTANT

Resetting the clock can affect the storage schedule of a unit in service.

If the clock is set back more than 5 minutes, the following actions will take place:

Data in storage buffers will be copied to the floppy disk and the buffers will then be cleared.

Data collection for storage will stop until the operator reinitializes the schedule.

If the clock is set back less than 5 minutes, collection of data storage and trends will stop until the setback time elapses and the clock "catches up" with the original collection schedule. A warning prompt will appear on the display before these actions occur. You can then cancel the clock change if desired.

4.23 Load/Store Configuration

Instrument configurations can be stored to and loaded from floppy disk. The front door must be closed. Configurations have filename extension .LNC.

Table 4-69 describes the Load/Store Config prompts.

Table 4-69 Load/Store Config Files Prompts

Prompt	Range/Selections	Definition
STORE CONFIG TO DISK	FILE01 CYCLE01 DRYER01 PROD01 RECORD01 TANK01 UNIT01 LOOP01 REACTR01 CONFIG01 KILN01 VESSEL01 CALIB01 WCHEM01 PRESS01 FURNCE01 DEMIN01 CONTRL01 BATCH01 FERMTR01 LEHR01 LINE01 STRLZR01 OVEN01 ZONE01	Specify a filename and number (01-99) for the configuration. Press Enter to store the configuration.
LOAD CONFIG FROM DISK	Select a configuration filename.	First you must clear the instrument's configuration memory. Press Enter to clear, or Menu to abort and exit the menu. Once the memory is clear, select a filename from the floppy disk. Press Enter to load the configuration into the instrument.

ATTENTION

Only function blocks that have been programmed are loaded to the instrument. Function blocks in the receiving instrument are not replaced unless the incoming function blocks are programmed differently. For example, if the instrument has AI1 and AI2 programmed, and the configuration being loaded from the floppy contains AI3 only, then AI1 and AI2 are undisturbed on the instrument and AI3 is added. If the configuration being loaded contains a different AI2 and a new AI3, then AI1 is undisturbed, AI2 is replaced by the different AI2, and AI3 is added.

4.24 Scan Rate

Scan rate is the time required to measure inputs, execute function blocks (AI, Loops, AO, DI, DO, CV, etc.) and update outputs. It is also known as the machine cycle, scan cycle, and update rate.

The Scan Rate prompt lets you set the scan rate of the instrument to a value slower than the maximum rate allowed by the hardware. The hardware will determine the default scan rate. Allowable entries are 250 milliseconds, 500 milliseconds, 1 second, 2 or 3 seconds. 250 ms rate is only available on 4 input units.

We recommend the following scan rates for the following configurations.

Table 4-70 Suggested Scan Rates

Inputs	Scan Rate	W/Control
Up to 4	250 msec	500 msec
Up to 12	500 msec	1 sec
Up to 16	750 msec	1 sec
Up to 24	1 sec	1.5 sec
Up to 32	1.5 sec	2 sec
Up to 44	2.0 sec	2 sec
Up to 48	3.0 sec	3 sec

NOTE

These are suggested scan rates. In general, if your instrument responds too slowly, use a slower (higher) scan rate. You can use a faster (lower) scan rate than suggested here, but be aware of possible sluggish display and button response time.

4.25 Select Language

SELECT LANGUAGE on the Main Program Menu changes the instrument's language to:

- English
- Spanish
- German
- French
- Italian

4.26 Data Storage

Overview

Data Storage lets you store trends, unit data, alarms, events, and diagnostics in separate files on a floppy disk for later analysis and review (replay). Data can be reviewed onscreen or on a PC with SDA data analysis software or the TrendManager Pro V5 software suite. Set point Programs, instrument configurations and calibrations are not part of the Data Storage feature.

Setup and configuration of Data Storage is described in this section; Online operation is described in Section 7.4.

Setup procedure

Data Storage setup is performed Online to avoid interruption of current storage. The steps are described briefly Table 4-71.

Table 4-71 Data Storage Setup Procedure

Step	Action
1	Access DATA STORAGE Online. Insert an initialized 100MB ZIP disk into the drive. If necessary, initialize disk using FORMAT DISK. See Opening/Closing the Front Door in Section 3.8.
2	Select ENABLE STORAGE. See Enable Storage below.
3	Select SET UP NEW SCHEDULES to specify storage data, mode, and other settings. See page 167.
4	Select DISK CAPACITY to specify storage rates. See page 172.
5	Select WARNING LEVEL % to define the capacity warning level.
6	Select INITIALIZE DISK, then select USE NEW SCHEDULES to initialize the disk with the settings you created in steps 3 and 4. See section 3.15.

Enable storage

Set to Enable to turn on storage. **If Disabled, no storage will occur, regardless of any other settings.**

Set Up New Schedules

This item contains setup menus for all data sets. Select it to specify what data to store and how to store it. If a type of data storage is not scheduled, no disk file will be created for it.

ATTENTION

If you make **any** changes to any item under SET UP NEW SCHEDULES, you must initialize using new schedules to activate those changes.

The following items appear under SET UP NEW SCHEDULES and are described under the following headings.

- **Trend Data 1**
- **Trend Data 2**
- **Trend Data 3**
- **Trend Data 4**
- **Alarms**
- **Events**
- **Diagnostics**
- **Unit Data**
- **Disk capacity**
- **Batch Control**

Trend Data 1

At the top of the display the message “SETUP IS CURRENT” indicates that current setup for storage of TREND 1 is exactly as shown. If the message is “SETUP IS NOT CURRENT”, then the TREND 1 setup has been changed since a disk was last initialized. To make a NOT CURRENT setup CURRENT, you must initialize the disk using new schedules.

Set up Trend Data 1 as described in Table 4-72.

Table 4-72 Prompts For Storage Setup Of Trends, Alarms, Events, Diagnostics

Prompt	Range/Selections	Definition
POINT #1 - POINT #12	Analog or discrete parameter	Select the data points for the trend.
STORAGE MODE	CONTIN, BATCH, or NONE	Continuous storage becomes active immediately upon initialization. Batch storage is controlled by a discrete parameter (see BATCH CONTROL) or by start/stop batch menu item. Batch data may be started and stopped several times in a single file until the file is full. Batch start increments a batch number that is stored along with the data. The batch number may be used for data retrieval and analysis using SDA data analysis software.
COPY DISPLAY SETUP		Select this to copy the following Trend 1,2, 3 or 4 Display data to Trend 1,2, 3 or 4 Storage data: Point #1–#12, set display limits, timebase (high rate) selector. Once setup is copied, it can be altered.
LOW RATE	Seconds: .5, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, 50 Minutes: 1, 2, 3, 4, 5, 10, 15, 20, 30, 40, 50 Hours: 1	Enter data collection rate. This is how often the data points are sampled.
HIGH RATE	Seconds: .5, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, 50 Minutes: 1, 2, 3, 4, 5, 10, 15, 20, 30, 40, 50 Hours: 1	Enter data collection rate. This is how often the data points are sampled.
ROLLOVER	ON, OFF	Select ON to continue gathering and storing data after the file becomes full. The new data will replace the oldest data on the disk as it is collected. No warning will be given. Select OFF to stop storage of this data type when the disk space for it becomes full. A “DISK FULL” message will then appear. Data is buffered until a new disk is inserted and initialized.
SET DISPLAY LIMITS	OFF or number	Enter upper and lower limit values for the trend display for each point. If OFF then the trend will use the programmed limits for each point.
HIGH RATE SELECTORS	SELECTOR	This discrete triggers the high storage rate when ON(1) and the low storage rate when OFF.
	CHANGE WITH KEY	This option enables/disables storage rate changes from the Trend display Point/Trend menu. If YES, storage Trend’s high rate will be used when display Trend’s alternate timebase is selected from the Online Point/Trend menu; Storage Trend’s low rate will be used when display Trend’s normal timebase is selected. See Table 6-2, Point/Detail Menu Prompts, Timebase.
EXTERNAL ENABLE	OFF, discrete parameter, 0, 1	When ON(1), this discrete parameter will allow storage of the data type; when off storage for the data type will stop. This enable is independent of the storage mode; it does not control batch start/stop.
SELECT FILENAME	FILE CYCLE DRYER PROD RECORD TANK UNIT LOOP REACTR CONFIG KILN VESSEL CALIB WCHEM PRESS FURNCE DEMIN CONTRL BATCH FERMTR LEHR LINE STRLZR OVEN ZONE	Select a file name to identify the type of data to be stored.

Trend Data 2, 3 & 4

Trend Data 2, Trend Data 3 and Trend Data 4 use the same prompts as in Table 4-72.

Alarms

Alarm data storage consists of a complete log of alarms, including time of occurrence, time of clearing, value of the alarm parameter, the alarm sense (high, low, etc.) and the batch identification number, if present. The alarm prompts are: STORAGE MODE, ROLLOVER, ALARM SAMPLES, EXTERNAL ENABLE, SELECT FILENAME. See Table 4-72 for descriptions.

The number of samples which can be stored in a file (ALARM SAMPLES) can be up to 1600. Depending on your selections, data collection will begin when the first alarm occurs, or when the first alarm occurs after a batch start.

Events

Event storage consists of a complete log of events including the event title, time of occurrence, the status or value after the change, and the batch identification number, if present. When event storage is running, loop and instrument mode events are always stored; discrete input and output events are stored only if first enabled under those items' program menus (see Sections 4.10 and 4.11).

Table 4-73 Stored Events

Event title	Event status/value
Setpoint choice	SP1, SP2
Control action	Forward, Reverse
Tuning Set	Set 1, Set 2
Instrument Mode	Online, Program, Maint
Control Mode	Auto, Manual, RMan
Set point 1	SP1's value
Set point 2	SP2's value
Control Output	Loop's output value
Discrete Input	On, Off
Discrete Output	On, Off

Event storage setup is done with the following parameters: STORAGE MODE, ROLLOVER, EVENT SAMPLES, EXTERNAL ENABLE, SELECT FILENAME. See Table 4-72 for parameter descriptions.

The number of samples which can be stored in a file (EVENT SAMPLES) can be up to 1600.

Depending on your selections, data collection will begin when the first event occurs, or when the first event occurs after a batch start.

Barcode data is also stored in the event file.

Diagnostics

Data storage for Diagnostics is a complete log of all diagnostic messages. It includes the diagnostic code or identifier message and its time and date of occurrence.

Setup is done with the following parameters: STORAGE MODE, ROLLOVER, DIAG SAMPLES, EXTERNAL ENABLE, SELECT FILENAME. See Table 4-72 for descriptions.

Depending on your selections, data collection will begin when the first diagnostic occurs, or when the first diagnostic occurs after a batch start occurs.

When calibration is executed, the record is time stamped and stored to the diagnostic file.

The number of samples which can be stored on a disk (DIAG SAMPLES) can be up to 1600.

Unit Data

Values for up to 12 points (analog input, calculated value, discrete input, discrete output, totalizer, etc.) can be sampled at user-definable intervals and stored on floppy disk. The sample interval must be set by a schedule or triggered by a discrete event. Prompts are described in Table 4-74.

Table 4-74 Unit Data Prompts

Prompt	Range/Selections	Definition
POINTS#1 – POINTS#12	OFF or analog parameter or discrete parameter	Enter up to 12 points.
STORAGE MODE	OFF, CONTIN, BATCH, or ON COMMAND	Continuous storage becomes active immediately upon initialization. Batch storage is controlled by a discrete parameter (see BATCH CONTROL, page 174) or by start/stop batch menu item. Batch data may be started and stopped several times in a single file until the file is full. Batch start increments a batch number that is stored along with the data. The batch number may be used for data retrieval and analysis using SDA data analysis software. ON COMMAND storage collects a single sample of data whenever the EXTERNAL ENABLE discrete makes an off-to-on transition. If this mode is used, then SET UP SCHEDULE is ignored.
COPY DISPLAY SETUP		Copies the data point list already set up for a currently active Unit Data display.
ROLLOVER	ON, OFF	Select ON to continue gathering and storing trend data after the Unit data file becomes full. The new data will replace the oldest data on the disk as it is collected. No warning will be given. Select OFF to stop trend storage when trend space becomes full. A “DISK FULL” message will then appear. Data is buffered until a new disk is inserted and initialized.
UNIT DATA SAMPLES	Enter a value from 0-1600	Number of samples.
EXTERNAL ENABLE	OFF, discrete parameter, 0, 1	This discrete parameter will allow Unit data storage when ON(1) and will stop Unit data storage when OFF(0). This enable is independent of the storage mode; it does not control batch start/stop.

Table 4-74 Unit Data Prompts (continued)

Prompt	Range/Selections	Definition
SELECT FILENAME	FILE CYCLE DRYER PROD RECORD TANK UNIT LOOP REACTR CONFIG KILN VESSEL CALIB WCHEM PRESS FURNCE DEMIN CONTRL BATCH FERMTR LEHR LINE STRLZR OVEN ZONE	Select a file name to identify the type of Unit data to be stored.
START HOUR	0-23	If no external enable is specified, select a starting date and time and an interval for periodic storage. Set Interval Days to 31 if you want the timed schedule to repeat on the same day each month. This timer schedule will run in any Data Storage mode. In CONTINUOUS mode, it will start as scheduled and collect samples until stopped by manual command (the ENABLE STORAGE in the Online Data Storage menu). In BATCH mode, the timer schedule will be started and stopped by an Online menu selection (BATCH STATE) by the operator, or by an optional discrete input designated as the BATCH CONTROL.
START MINUTE	0-59	
START MONTH	JAN-DEC	
START DAY	1-31	
START YEAR	1994-2038	
INTERVAL DAYS	0-31	
INTERVAL HOURS	0-24	
INTERVAL MINS	0-59	

Disk capacity

Choose DISK CAPACITY under SET UP NEW SCHEDULES menu to allocate trend storage. See Table 4-75.

Table 4-75 Disk capacity Prompts

Prompt	Range/Selections	Definition
DISK CAPACITY		Displays total time available for non-rollover trend storage based on the low storage rates programmed. See Table 4-76 Disk Storage Capacity of 100MB ZIP disk.
TREND#1 LO RATE	Seconds: .25, .5, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, 50 Minutes: 1, 2, 3, 4, 5, 10, 20, 30, 40, 50 Hours: 1	This rate can be altered here or in the trend data setup (see Table 4-72). If the low storage rates are changed, the disk capacity will reflect the new trend capacity. Enter data collection rate. This is how often the data points are sampled. The .25 ms selection is only available for 2-input instruments with no more than 3 points total in Trends 1-3. The .5 sec rate cannot exceed 6 points total in Trends 1-3.
TREND#1 HI RATE	Seconds: .25, .5, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, 50 Minutes: 1, 2, 3, 4, 5, 10, 20, 30, 40, 50 Hours: 1	This rate can be altered here or in the trend data setup (see Table 4-72). If the hi storage rates are changed, the disk capacity will reflect the new trend capacity. Enter data collection rate. This is how often the data points are sampled. The .25 ms selection is only available for 2-input instruments with no more than 3 points total in Trends 1-3. The .5 sec rate cannot exceed 6 points total in Trends 1-3.
TREND#2 LO RATE	See TREND#1 LO RATE	
TREND#2 HI RATE	See TREND#1 HI RATE	
TREND#3 LO RATE	See TREND#1 LO RATE	
TREND#3 HI RATE	See TREND#1 HI RATE	
TREND#4 LO RATE	See TREND#1 LO RATE	
TREND#4 HI RATE	See TREND#1 HI RATE	

Table 4-76 Disk Storage Capacity of 100MB ZIP disk

(The values shown below are for **each** Trend file) 24000000 bytes per file.

POINTS PER FILE	STORAGE RATE: 1 sec.	5 sec.	10 sec.	30 sec.	1 min	10 min.	30 min.	1 hour
2	13.5 days	2.2 months	4.5 months	1.1 years	2.2 years	22.2 years	66.8 years	133.7 years
4	8.1 days	1.3 months	2.7 months	8.1 months	1.3 years	13.3 years	40.1 years	80.2 years
6	5.9 days	29.8 days	1.9 months	5.9 months	11.9 months	9.8 years	29.4 years	58.8 years
8	4.8 days	24.4 days	1.6 months	4.8 months	9.7 months	8.0 years	24.0 years	48.1 years
10	3.7 days	18.9 days	1.2 months	3.7 months	7.5 months	6.2 years	18.7 years	37.4 years
12	3.2 days	16.2 days	1.0 month	3.2 months	6.5 months	5.3 years	16.0 years	32.1 years

Batch Control

Specify a discrete parameter as the START/STOP switch for all data types whose storage mode is set to “BATCH”.

ATTENTION

If no BATCH CONTROL parameter is defined here, batch storage is started/stopped instead through the menu item BATCH STATE. If a parameter is defined here, BATCH STATE menu item is disabled.

Initializing a disk

Select INITIALIZE DISK from DATA STORAGE. Initialization activates storage and creates a file for each data set (Trends 1-4, alarms, events, unit data, diagnostics). Filename extensions are as follows.

Table 4-77 Filename Extensions Of Data Storage Types

Data set	Extension
Trend data	.LNT
Alarms	.LNA
Events	.LNE
Unit Data	.LNU
Diagnostics	.LND

Select USE NEW SCHEDULES to store the new storage schedules. If you choose USE CURRENT SCHEDULES, the disk is initialized using the current setup (the setup from the previous initialization), not the new setup. Typically the operator will choose USE CURRENT SCHEDULES to continue storing the same setup onto a new disk.

IMPORTANT

Initialization deletes any data already on the disk, therefore, you are prompted to press Enter to proceed or to press Menu to abort.

When the INITIALIZING DISK message disappears, initialization has completed. If initialization fails, see Table 6-6 for message descriptions.

ATTENTION

Refer to section 3.15 for additional information on disk initialization.

5. Setpoint Profiler

What's in this section?

Section 5 explains the functions, configuration, and operation of the Setpoint Profiler. Terminology is defined and all prompts are explained.

5.1 Overview of the Setpoint Profiler

Definitions

A *profiler* is a Setpoint Profiler function block. This function block is what you interact with when you program and run a profile. The profiler is analogous to a compact disk player on a stereo, in that the profiler "plays" a profile. Your instrument contains 1, 2, 3, or 4 profilers, depending on the option ordered.

A *profile* is a series of ramp and soak segments, along with any parameters associated with those segments, such as segment loops, events, and guaranteed soak enables. The setpoint produced by the profile is used by a control loop's Setpoint #2. A profile is also known as a curve or recipe. A profile is analogous to a compact disc, in that the profile is "played" by the profiler. Your instrument contains 1, 2, 3, or 4 profiles, depending on the option ordered.

A *program* is a set of one to four profiles, depending on the instrument. Programs in a single profile instrument contain 1 profile, programs in a two-profile instrument contain 2 profiles, programs in a three-profile instrument contain 3 profiles, and programs in a four-profile instrument contain 4 profiles.

Guaranteed soak is a set of parameters that hold the profiler when the deviation between the generated setpoint and either PV is larger than a configured limit.

Event outputs are discrete output parameters of the Setpoint Profiler function block. They may be tied to other function blocks such as Discrete Outputs.

Profile features

Each profile has the following features:

- A second PV is available. Each PV is monitored for excessive deviation from the profile value, in which case the profiler can be automatically put on Hold.
- Menu or discrete control of profile resetting, starting, holding, advancing, shutting down, or fast forwarding through the profile.
- Discrete input for starting the profiler at the current value of the process variable. Known as "hot start."
- Discrete input for enabling/disabling guaranteed soak over the entire profile.

- Guaranteed soak configurable per segment.
- Discrete outputs to indicate profile state, including Ready, Run, Hold, In Progress, and At End.
- Up to 16 Discrete outputs (Events) programmable per segment.
- Four user-selectable methods for ramping.
- Automatic recycling of the profile.
- Up to four levels of looping within profile.
- Jumping to another segment.
- Batch operation, including shutdown profiling, activated through a discrete input or online menu.

Schematic of the Setpoint Profiler function block

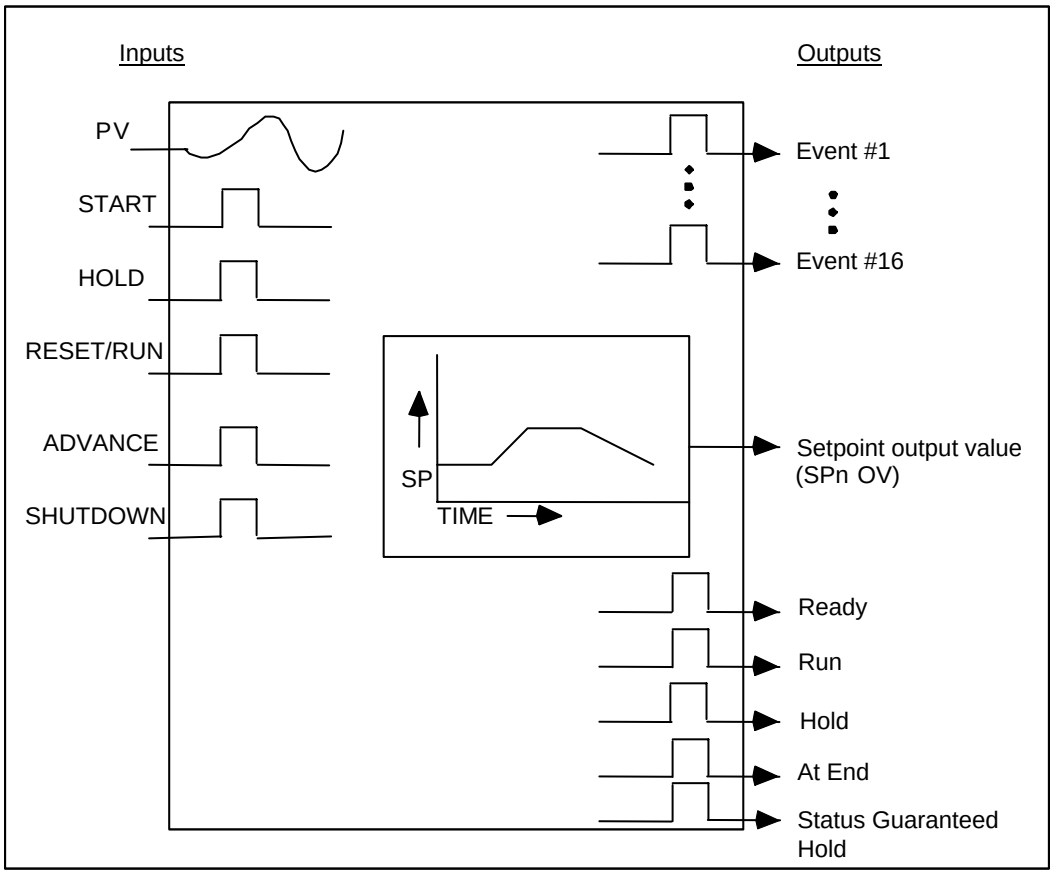


Figure 5-1 Setpoint Profiler Schematic

Two types of profiles

A *single phase* profile is the simpler of the two profile types. It does not contain startup and shutdown segments. It runs from Segment 1 to the last segment.

A *multiphase* profile divides the profile into three phases: the *startup phase*, the *batch phase*, and the *shutdown phase*. With a multiphase profile you can rerun the batch phase multiple times (known as AUTO CYCLING), or skip to the shutdown phase. The batch phase of a multiphase profile is specified by the BATCH FIRST SEGMENT and BATCH LAST SEGMENT prompts. See Figure 5-2.

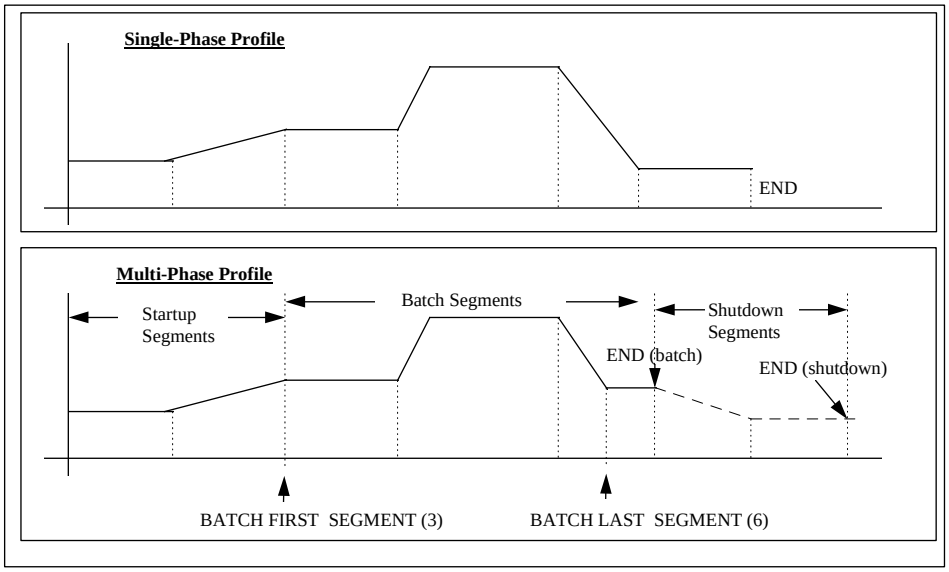


Figure 5-2 Single and Multi-phase Profiles

5.2 Components of a profile

Two PVs available

Each profile can monitor up to 2 process variables. The second PV is for monitoring a second variable related to your process. The value of each PV is compared with the value of the profile. If the difference between either PV and the profile value exceeds specified amounts, the profiler will Hold (soak), if enabled to do so.

Number of segments

Up to 63 segments may be in a profile.

Time Units

All segments use the same time base (seconds, minutes, or hours).

4 types of ramp segments

There are four ramp types selectable at the RAMP TYPE prompt.

1. Value/Duration
2. Time
3. Rate
4. External

Value/Duration (Val/Dur)Ramp Type

This is the only ramp type that allows consecutive ramps or soaks. VALUE is the beginning value of the segment; TIME is the time needed to reach the VALUE of the next segment.

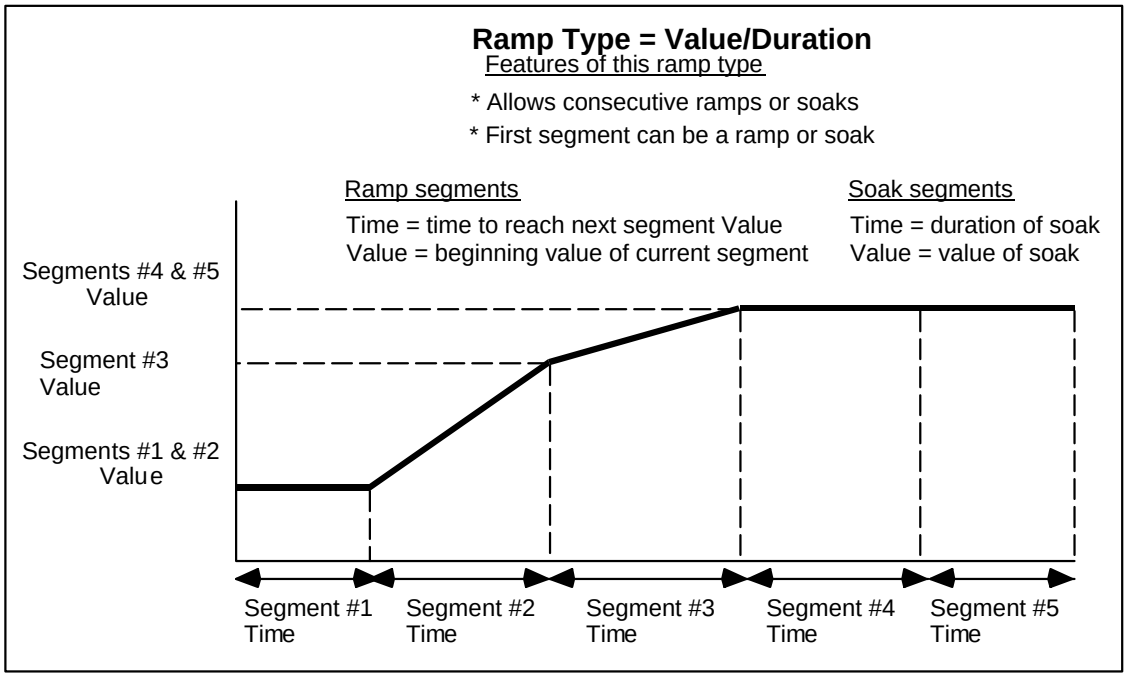


Figure 5-3 Value/Duration Ramp Type

To properly terminate a Val/Dur profile you must program the segment ***beyond*** the last segment with the following:

1. The value you want the program to "end" with. Looking at Figure 5-3, the last segment is a soak, thus the Value of segment #6 should be set to the same value used in segment #5. Any other value will cause segment #5 to be a "ramp" since the value will ramp up (or down) from segment #5's value to segment #6's value.
2. Set the TIME to "OFF".

Time Ramp Type

Each ramp segment's TIME is the time allotted for the profiler output to reach the next soak segment's VALUE. The ramp segment's VALUE prompt is not used.

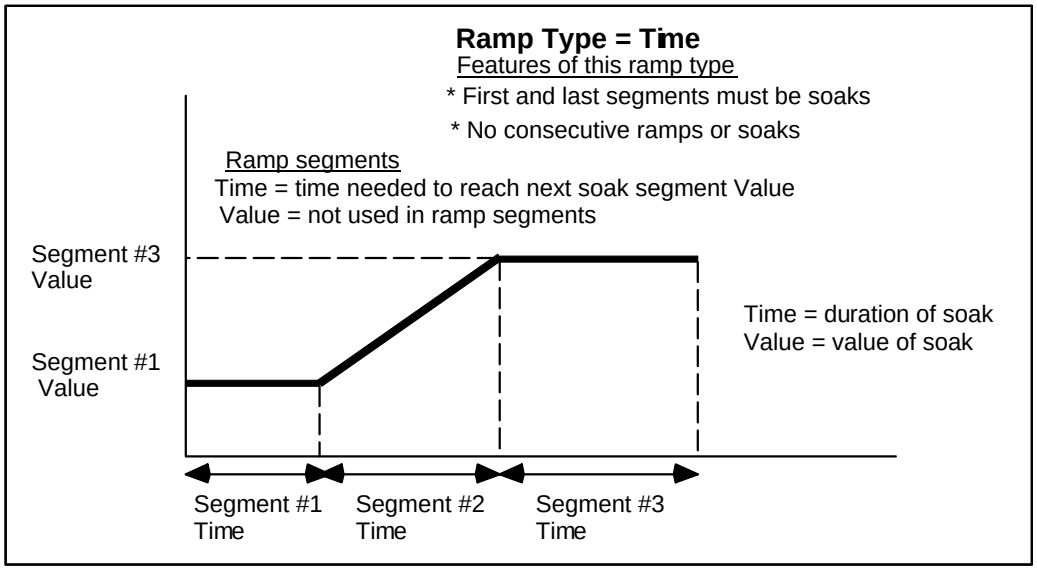


Figure 5-4 Time Ramp Type

Rate Ramp Type

Each ramp segment's TIME specifies the rate at which the profiler output will reach the next soak segment, where the rate is specified by the prompts TIME/TIME UNITS. The ramp segment's VALUE prompt is not used.

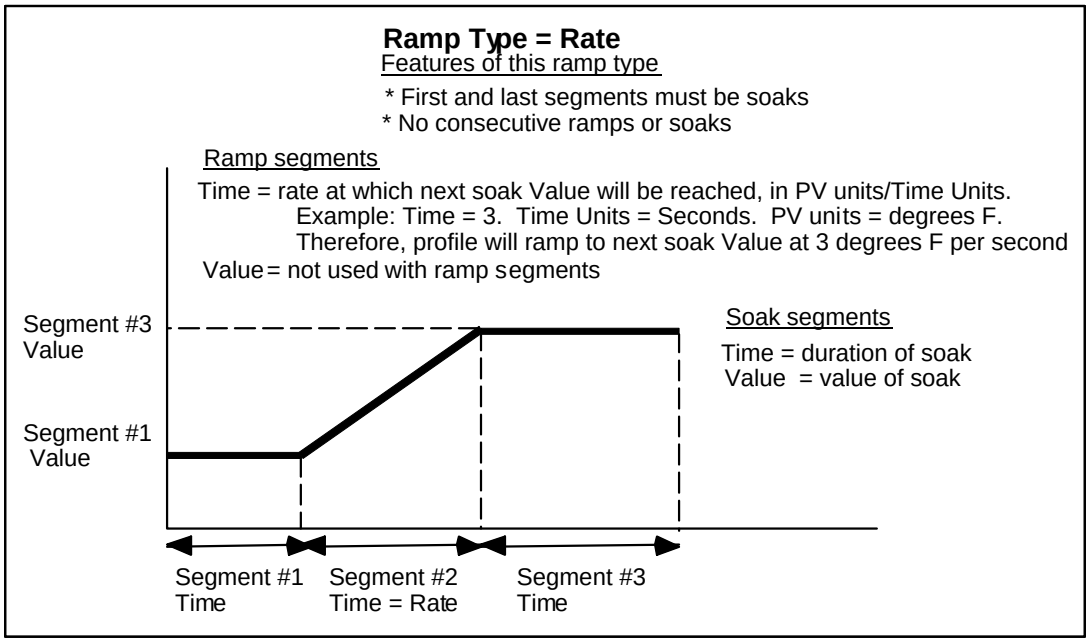


Figure 5-5 Rate Ramp Type

ATTENTION

Rate ramp type's TIME prompt is in engineering units of the PV, not in time units (seconds, minutes, or hours).

External Ramp Type

This ramp type works with the RAMP INCREMENT discrete input. During a ramp segment, each time RAMP INCREMENT changes from OFF to ON, the profiler output incrementally changes by the amount specified in the ramp segment's TIME (in units of the PV). When RAMP INCREMENT changes from ON to OFF, the profiler output soaks at its present value. This increment-soak repeats until the profiler output reaches the VALUE of the next soak segment. The ramp segment's VALUE prompt is not used.

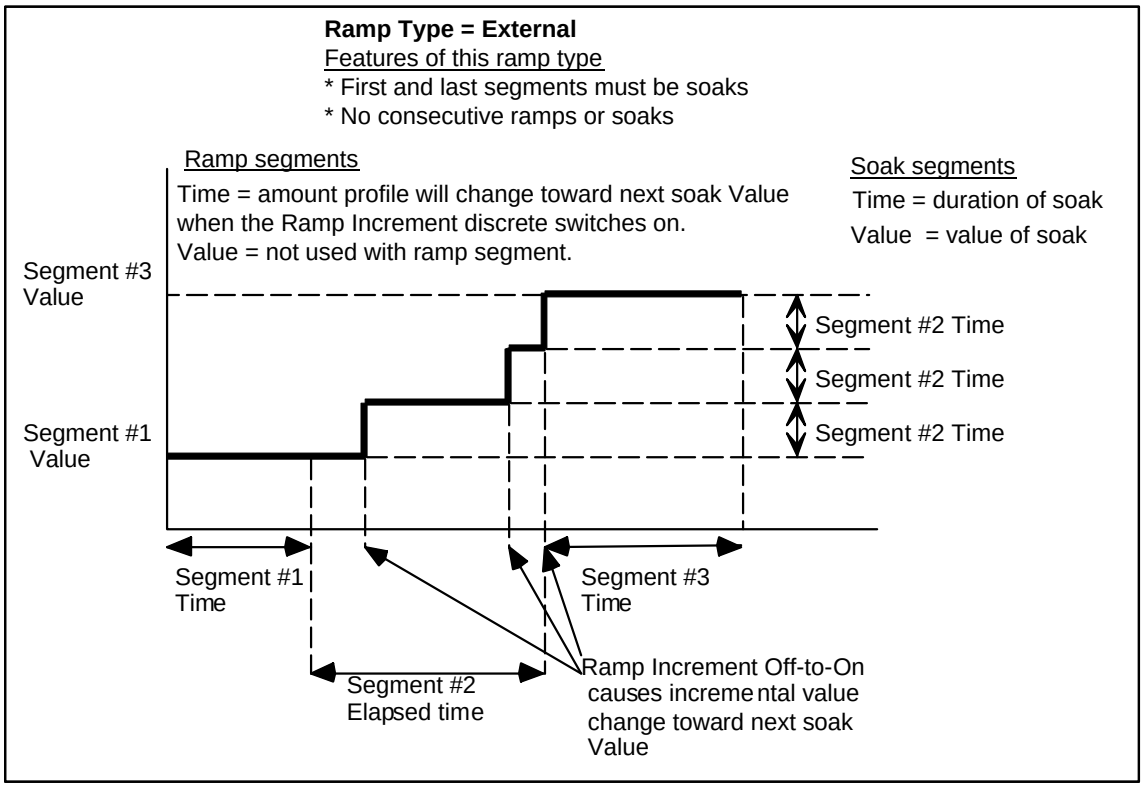


Figure 5-6 External Ramp Type

ATTENTION

- External ramp type's TIME prompt is in engineering units of the PV, not in time units (seconds, minutes, or hours).
- To increment toward a lower soak value, enter a positive TIME amount. The Setpoint Profiler "knows" to increment or decrement this amount toward the next soak value.

Soak segment

All soak segments have a beginning VALUE and a TIME during which that value is maintained. This is true regardless of the ramp type used.

Guaranteed Soak

Guaranteed soak will Hold the profile value if either PV to the profile (typically a Control Loop's PV) deviates specified amounts above or below the profiler output. See Figure 5-7. For a guaranteed soak to occur, the following conditions must be met:

1. The GUAR SOAK #1 and GUAR SOAK #2 prompts for the segment (ramps *and* soaks) must be enabled (set to ON),

and

2. The GUARANTEED SOAK discrete input to the profile must be enabled (level high).

If either of these are disabled, a guaranteed soak cannot occur, even with excessive deviation between profile and PV.

Hysteresis

This parameter specifies the amount the deviation between profile and PV must be reduced before the profile resumes running after a guaranteed soak. See Figure 5-7.

After a guaranteed soak the profile will resume running when the deviation has decreased by this amount.

The following examples assume GUARANTEED SOAK is ON(1), and the example segment's GUAR SOAK #1 is ON(1).

Example #1

Assume PV #1 is 20 units above the profile output, GUAR SOAK HI LIM is 15, HYSTERESIS is 5. The profile will Hold because the deviation high limit is exceeded. The profile will resume running when the PV #1 is 10 (15-5) units or less above the profile output.

Example #2

Assume PV #1 is 20 units below the profile output, GUAR SOAK LO LIM is 15, HYSTERESIS is 5. The profile will Hold because the deviation low limit is exceeded. The profile will resume running when the PV #1 is 10 (15-5) units or less below the profile output.

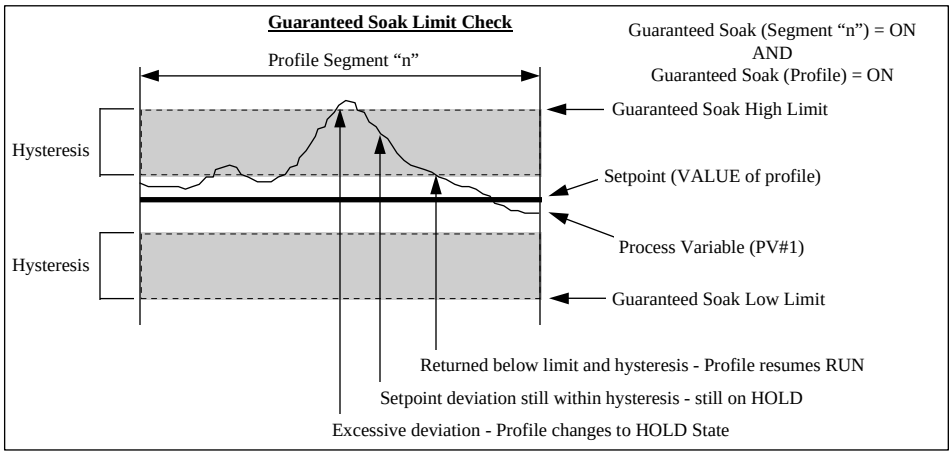
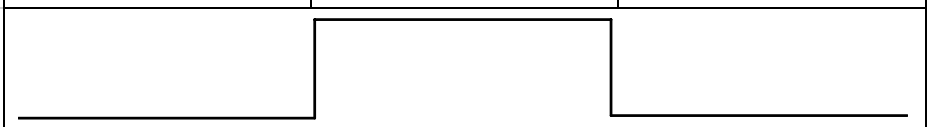


Figure 5-7 Guaranteed Soak and Hysteresis

Segment Events

Each segment contains 16 programmable discrete event outputs whose ON/OFF states- specified by you -can be used to trigger other discrete functions. The segment's event states are activated at the beginning of the segment and are maintained unless changed by the next segment in the profile. See Table 5-1. The last segment's event states are maintained after the profiler is ended.

Table 5-1 Example of Segment Events

	Segment #1	Segment #2	Segment #3
Event 1 State	1 (ON)	0 (OFF)	0 (OFF)
			
Event 2 State	0 (OFF)	1 (ON)	0 (OFF)
			
Event 3 State	1 (ON)	0 (OFF)	1 (ON)
			

To activate events in the middle of a ramp segment, replace the desired segment with 3 segments: a ramp, a very short soak, and another ramp. Program the second and third segment events as if they were the middle of the segment.

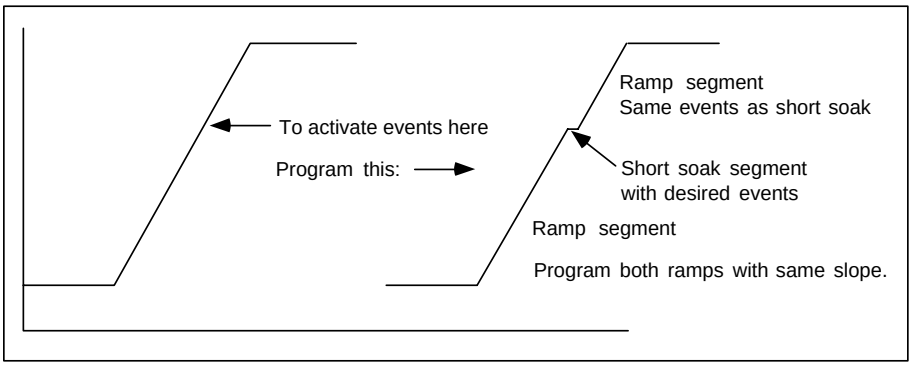


Figure 5-8 Activating Events In Mid-Segment

Segment Loops

You can program up to four segment loops within a profile. A segment loop is one or more consecutive segments which must repeat a selected number of times before proceeding to the next segment outside of the loop.

Segment loops are specified by the parameters REPEAT COUNT, FROM SEGMENT #, and TO SEGMENT #. Loops are reset when Auto Cycle is reset and when the profile is reset. Loops can contain other loops but cannot overlap.

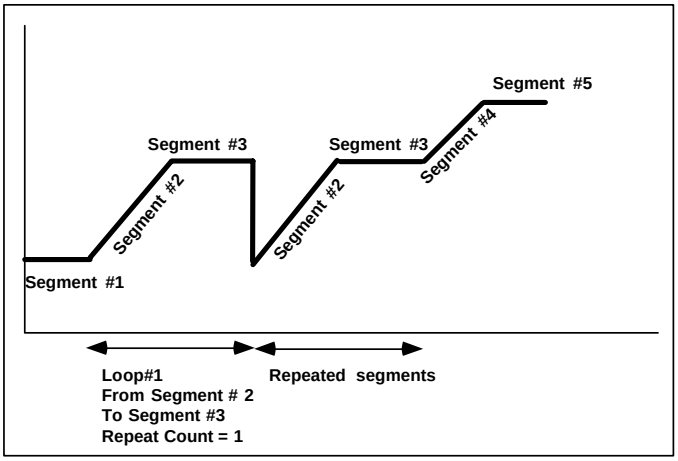


Figure 5-9 Example Of A Segment Loop

Examples of valid loops

Loop #1: LOOP FROM SEGMENT = 1
LOOP TO SEGMENT = 10
Loop #2: LOOP FROM SEGMENT = 1
LOOP TO SEGMENT = 9

Loop #1: LOOP FROM SEGMENT = 1
LOOP TO SEGMENT = 10
Loop #2: LOOP FROM SEGMENT = 2
LOOP TO SEGMENT = 10

Loop #1: LOOP FROM SEGMENT = 1
LOOP TO SEGMENT = 10
Loop #2: LOOP FROM SEGMENT = 2
LOOP TO SEGMENT = 9

Example of invalid (overlapping) loops

Loop #1: LOOP FROM SEGMENT = 1
LOOP TO SEGMENT = 9
Loop #2: LOOP FROM SEGMENT = 2
LOOP TO SEGMENT = 10

5.3 Parameters that control a profile's execution

Coordinating operation of multiple profilers

In a multi-profiler instrument the profiles in a program can be totally unrelated to each other, that is, you can give them different times and settings. *If you want the profilers to be coordinated, you must configure each profiler that way.* For example, if you want all your profilers to be started by the same signal, you must configure each profiler with the same START parameter. The Copy Block function in the Program menu lets you copy parameters from one profiler to another.

SPP synchronization

Allows a multiple SPP user to synchronize several SPPs for when one enter hold due to a guaranteed hold, the others will enter hold and when the one that entered hold leaver hold the others will leave hold also. This is done by using a block output status called SG (status guaranteed hold) that is high when the block is in guaranteed hold mode. If different SPPs are used, the SPPx SG outputs should run through an OR block and then the output of the OR block back to the SPPx HOLD input. The SG status output may be viewed on the discrete status screen.

Discrete inputs

You can program a profiler with discrete inputs that enable you to reset, start, hold, advance, shut down, or fast forward through the profiler, hot start the profiler from a live process variable, increment a ramp segment, or enable/disable guaranteed soak. See Table 5-2.

Note that some discretes are *edge-sensitive* and some are *level-sensitive*. Edge-sensitive means that the action is triggered by the discrete's transition from OFF to ON (rising edge) or from ON to OFF (falling edge). The changing status is what triggers the action, not the status itself. Some discretes, such as START, are rising edge-sensitive only and are not affected by a falling edge. When START's discrete goes ON, the profiler starts to run; when the discrete goes OFF, the profiler continues running.

Level-sensitive means that one action occurs while the discrete is ON and another action occurs while the discrete is OFF. The status is what causes the action, not the changing status. Fast forward's discrete is level-sensitive; that is, the profiler will run in fast forward while the discrete is ON but not while it is OFF.

Table 5-2 Parameters That Control Profiler Execution

Parameter name	Definition	Triggered by	Conditions present	Result
START	Starts Profiler from Ready, Hold, or End state. Activated by operator menu or by discrete input. May be connected to the F1 key (SY1F1).	Rising edge	Profiler in Ready or End state	Profiler starts to Run.
RESET/ RUN	The behavior of this parameter depends on START. If the START discrete input is programmed with a discrete, then switching RESET/RUN from OFF to ON resets an Ended, Hold, or Ready profiler to the starting value of segment 1.	Rising edge	Start is programmed with a discrete parameter & profiler is in Ready or Hold or End	Profiler changes to Ready and goes to Segment #1.
	If the START discrete input parameter is *not* programmed with a discrete, then switching RESET/RUN from OFF to ON resets an Ended, Hold, or Ready program to the starting value of segment 1 and to the profiler's Ready state. On a transition from ON to OFF, starts an Ended profiler.	Rising edge	START is not programmed with a discrete parameter & profiler is in Ready or Hold or End	Profiler changes to Ready and goes to Segment #1.
	RESET/RUN does not affect a running program. May be connected to the F3 key (SY1F3).	Falling edge	START is not programmed with a discrete parameter & profiler is at End	Profiler goes to Segment #1 and starts to Run.

Table 5-2 Parameters That Control Profiler Execution (continued)

Parameter name	Definition	Triggered by	Conditions present	Result
HOLD	Holds a profiler at its current position. Profiler's Elapsed Time continues but Segment Time stops until Profiler is started again. Hold is activated by online operator menu or by a discrete input. May be connected to F2 key (SY1F2).	Level ON	Profiler is in Run or Hold	Profiler is put in Hold
ADVANCE	Advances a profiler on Hold to the starting value of the next segment. If the profile is on the last segment, it advances to the ending value of the last segment. If the profile is on the ending value of the last segment of the batch, then it advances around to the starting value of segment 1, or to the first segment of the batch phase as defined by BATCH SEGMENT FIRST. If within a loop, advances to next segment in the loop. Advance is activated by online operator menu or by a discrete input.	Rising edge	Profiler is in Hold	Profiler advances
HOT START	When HOT START is ON and the profiler is started, the profiler begins to run at the point in the profile where the current value of PV #1 first occurs. Hot Start makes the profiler skip over unneeded segments. Hot Start is activated by a discrete input. Example If PV #1 is 100 and the profile contains the value 100 in Segment 4 and Segment 6, HOT START forces the profiler to start running at Segment 4 at 100, not at Segment 1 or Segment 6. See Figure 5-10 Hot Start.	Level ON	Profiler is in Ready	When profiler changes from Ready to Run, profiler jumps to the same value as PV #1

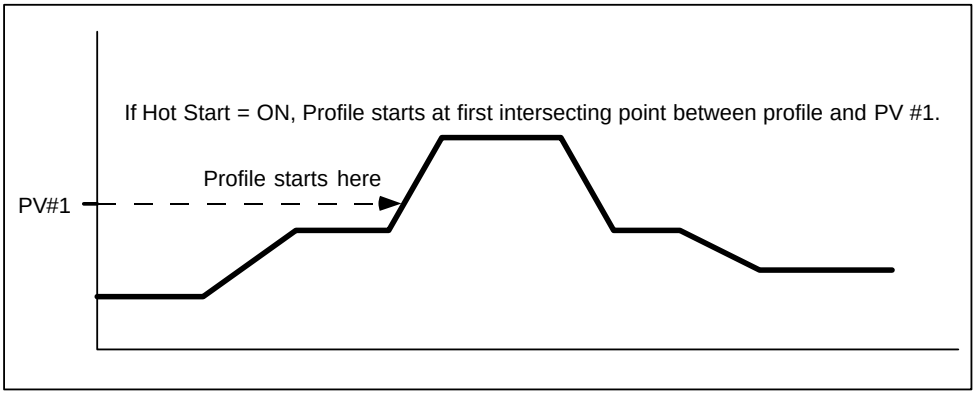


Figure 5-10 Hot Start

Parameter name	Definition	Triggered by	Conditions present	Result
FAST FORWARD	FAST FORWARD is a way to test for proper functioning of the profiler's events and outputs, without having to wait for the profiler to execute at its normal speed. When FAST FORWARD is ON, the profiler will run at a speed determined by the TIME MULTIPLIER parameter. The higher the time multiplier, the faster the profiler will run. Fast Forward is activated by a discrete input. Example The Programmer is running at a 500msec scan rate. The TIME MULTIPLIER is set to 60. Therefore the profiler will run 60 times faster than normal. The profiler will increment in (500msec x 60) or 30 second increments. Put another way, every half-second the profiler will advance 30 seconds. See Figure 5-11 Fast Forward.	Level ON		When in Run mode, profiler runs at Fast Forward speed.

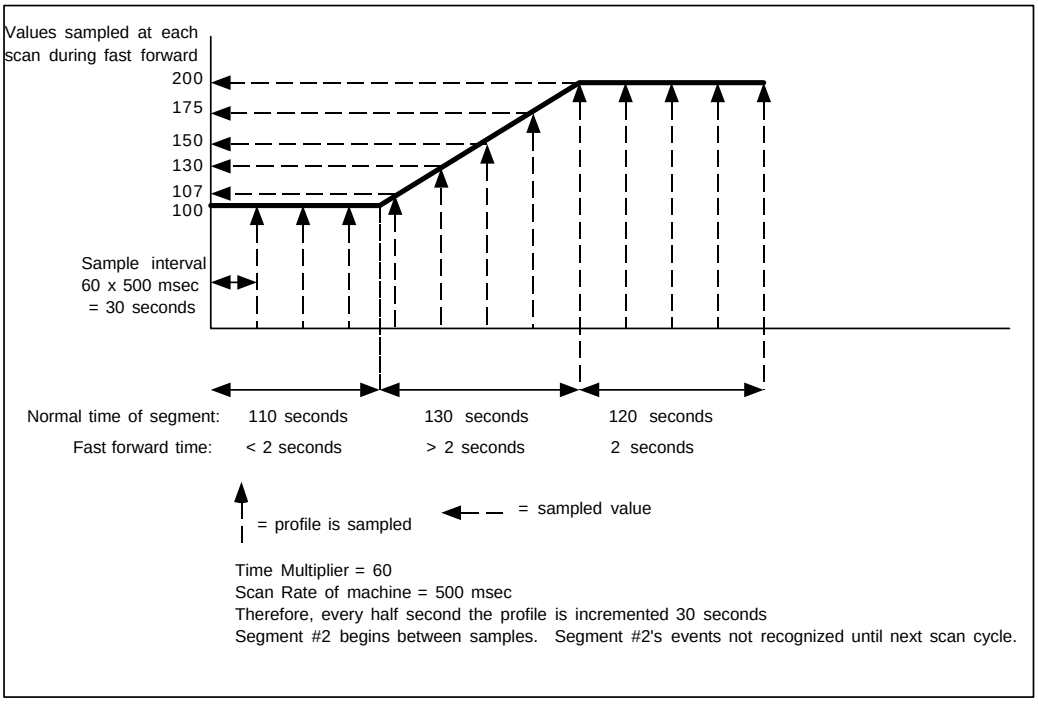


Figure 5-11 Fast Forward

Parameter name	Definition	Triggered by	Conditions present	Result
SHUTDOWN	When Shutdown is activated by a discrete input or by the operator menu, the profiler jumps from the batch phase to the shutdown phase of a multiphase profile. The shutdown phase begins at the segment defined by the parameter BATCH LAST SEGMENT+1. Shutdown is useful when you need to shut down your process without waiting for the profiler to finish a batch. Example BATCH FIRST SEGMENT, which specifies the start of the batch phase of the profile, is set at Segment 3. The last segment of the batch phase, BATCH LAST SEGMENT, is set at Segment 7. The last segment of the profile is Segment 9. When SHUTDOWN changes from OFF to ON, the profiler will jump to Segment 8, the first segment of the shutdown phase of the profile. See Figure 5-12 Shutdown	Rising edge	Profiler is in Run, Hold, or End	Profiler jumps to BATCH LAST SEGMENT + 1

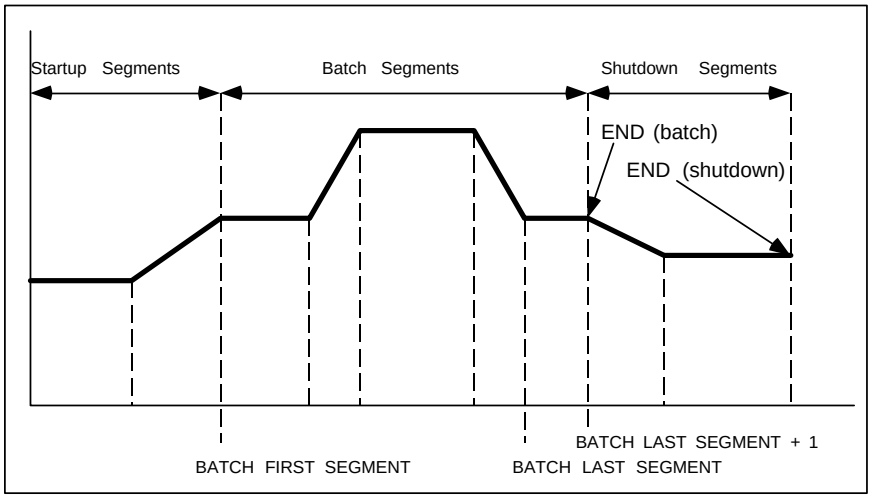


Figure 5-12 Shutdown

RAMP INCREMENT	See External Ramp Type on page 180.	Rising edge	Profiler is in Run mode & RAMP TYPE of profiler is External	Profiler increments by amount specified by the segment's TIME.

Parameter name	Definition	Triggered by	Conditions present	Result
GUARANTEED SOAK	See Guaranteed Soak on page 182.	Level ON	Excessive deviation between profiler and PV #1 or PV #2 & the segment's GUAR SOAK #1 or GUAR SOAK #2 is enabled.	Profiler is put on Hold
HOLD LEVEL/EDGE				
EDIT	Grants access to the profile's segments edition page, see table 5-5.			

5.4 How to set up a profiler

Up to 4 profilers can be programmed, depending on the options on your instrument. There are two menus for programming a profiler: PROGRAM PROFILERS in the Program menu, and SETPOINT PROFILES in the Online menu. Both must be accessed to program a profiler. Both menus are described in this section.

Program Profilers menu (in Program mode)

This menu lets you define various parameters for controlling the profiler's execution. To access the Program Profilers menu:

1. Press the Menu button until a main menu is displayed.
2. Select Set Mode and change the mode to Program.
3. Select Program Profilers.
4. Select a profiler (#1 through #4) to program. Only profilers that are not actively running are selectable.

Table 5-3 briefly describes the prompts for all profilers. For detailed descriptions, refer to Sections 5.2 and 5.3. See Table 4-2 for additional prompts.

Table 5-3 Program Profiler Prompts

Prompt	Range/Selections	Definition
DISPLAY LO LIM	OFF or number	Enter the lower limit for the SP Trend display. Allow for the maximum and minimum Profiler and PV values.
DISPLAY HI LIM	OFF or number	Enter the upper limit for the SP Trend display, allowing for the maximum and minimum Profiler and PV values.
PV #1	OFF, analog parameter, number	Program the profiler to monitor a process variable. PV #1 is trended on the SP Trend display. PV #1 is compared to the profiler's value to determine deviation. Excessive deviation between PV #1 and profiler value can cause a Hold (guaranteed soak).
PV #2	OFF, analog parameter, number	This is an optional PV that can also be monitored and can be used to determine deviation from profiler value. PV #2 is shown on SP Trend display's Point/Detail menu. PV #2 is also trended on SP Trend display.
START	Discrete parameter, 1, 0, or OFF	See Start on page 185.
RESET/RUN	Discrete parameter, 1, 0, or OFF	See Reset/Run on page 185.
HOLD	Discrete parameter, 1, 0, or OFF	See Hold on page 186.
ADVANCE	Discrete parameter, 1, 0, or OFF	See Advance on page 186.
HOT START	Discrete parameter, 1, 0, or OFF	See Hot Start on page 186.
FAST FORWARD	Discrete parameter, 1, 0, or OFF	See Fast Forward on page 187.
SHUTDOWN	Discrete parameter, 1, 0, or OFF	See Shutdown on page 188.
RAMP INCREMENT	Discrete parameter, 1, 0, or OFF	See External Ramp Type on page 180.
GUARANTEED SOAK	Discrete parameter, 1, 0, or OFF	See Guaranteed Soak on page 182.
HOLD LEVEL/EDGE	LEVEL or EDGE	Select LEVEL to Hold the profiler while the Hold discrete is Level ON, and resume Run when the Hold discrete is Level OFF. Select EDGE to Hold the profiler after the Hold discrete changes from OFF to ON, and resume Run after the Start discrete changes from OFF to ON.

Setpoint Profiles Menu (in Online mode)

This menu lets you define profile ramp and soak segments and associated parameters, and store and load programs to and from floppy disk or memory. See Figure 5-13 for allowable and non-allowable storage.

To access the Setpoint Profiles menu:

1. Press the Menu button until a main menu is displayed.
2. Select Set Mode and change the mode to Online.
3. Select Setpoint Profiles.
4. Select a profile (#1 through #4) to program.

Table 5-4, Table 5-5, Table 5-6 and describe the Setpoint Profile prompts.

Table 5-4 Setpoint Profiles Prompts

Prompt	Range/Selections	Definition
EDIT PROFILE #1 EDIT PROFILE #2 EDIT PROFILE #3 EDIT PROFILE #4		Select a profile to edit. See Table 5-5 for prompts.
STORE PROGRAM TO DISK	STARTING PROFILE #	Select 1-4. Select the lowest numbered profile to be stored; that is, Profile 1, 2, 3, or 4. See *How programs are stored on a disk* on page 200 for details.
	NUMBER OF PROFILES	Select 1-4. Number of profiles (1, 2, 3, or 4) determines how many profiles will be stored, starting with the Starting Profile #. For example, if Starting Profile # is 1 and Number of profiles is 3, then Profiles 1, 2, and 3 are stored. See *How programs are stored on a disk* on page 200 for details.
	FILE	Select the filename and number. Filename extension is .LNS. After you select the number and press Enter, the profile(s) are stored to disk.
	FILES ON DISK	Lists all files on the disk.
STORE PROGRAM TO MEMORY	PROGRAM NUMBER	Select 1-12. There are up to 96 “slots” allotted for profile memory storage. Depending on how many profiles your instrument has, each program will contain a certain number of profiles. See *How programs are stored to memory* on page 198 for details.
	STORE PROGRAM TO MEMORY	Select this to store program to memory.

Table 5-4 Setpoint Profiles Prompts (continued)

Prompt	Range/Selections	Definition
LOAD PROGRAM FROM DISK	Files with .LNS extension.	Select a program to load into the Setpoint Profiler function block. Press Enter to load. Existing profiles in the instrument will be replaced by the profiles in the program being loaded. Example You are loading Program1.LNS which contains Profiles #1, #2, and #3. These profiles will replace the profiles currently set up in the instrument. Profile #4 will not be replaced.
LOAD PROGRAM FROM MEMORY	PROGRAM NUMBER	Select a program 1-96 to load into the Setpoint Profiler function block. There are up to 96 “slots” allotted for program memory storage. Depending on how many profiles your instrument has, each program will contain a certain number of profiles. See *How programs are stored in memory* on page 198 for details.

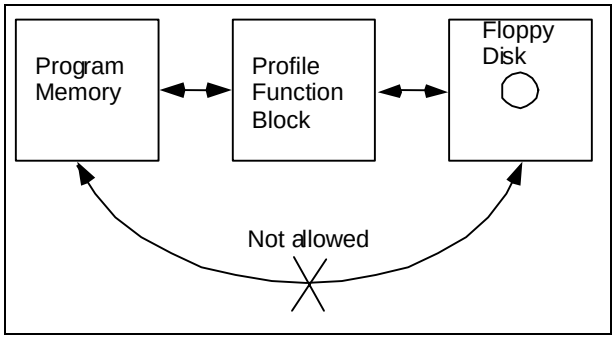


Figure 5-13 Allowable and Non-Allowable Program Storage

Table 5-5 Edit Profile Prompts

Prompt	Range/Selections	Definition
RAMP TYPE	VAL/DUR, TIME, RATE, EXTERNAL	See *4 types of ramp segments* on page 178.
TIME UNITS	SECS, MINS, HOURS	Select the time units to be used by all segments of the profile.
EDIT SEGMENTS		See Table 5-6.
GUAR SOAK LO LIM	OFF or number	The profiler will Hold if PV #1 or PV #2 deviates more than this much below the profiler output. See *Guaranteed Soak* on page 182 for details.
GUAR SOAK HI LIM	OFF or number	The profiler will Hold if PV #1 or PV #2 deviates more than this much above the profiler output. See *Guaranteed Soak* on page 182 for details.
HYSTERESIS	OFF or number	See *Hysteresis* on page 182 for details.
BATCH FIRST SEGMENT	0-63	Specify the first segment of the batch phase. Prior segments are the start-up phase. A value of 0 indicates a single phase profile. See *Two types of profiles* on page 177 for details.
BATCH LAST SEGMENT	0-63	Specify the last segment of the batch phase. Segments after this segment are the shutdown phase. A value of 0 indicates a single phase profile. See *Two types of profiles* on page 177 for details.

(continued)

Table 5-5 Edit Profile Prompts (continued)

Prompt	Range/Selections	Definition
AUTO CYCLE	OFF, ON	Select ON to have the profile (or batch phase if defined) repeat AUTO CYCLE COUNT times. Automatically re-runs the profile when ON. The parameter AUTO CYCLE COUNT controls the number of additional cycles through the profile. When AUTO CYCLE is ON and AUTO CYCLE COUNT is zero (0), the profile will cycle forever. For a single phase profile, the profiler must progress to the END state before cycling back to segment 1. Once the profiler is ENDed, the automatic cycling function will change the profiler to the READY state for one machine cycle (clearing the profiler's discrete outputs) before proceeding to the RUN state. The elapsed time of the profiler will continue due to re-cycling. For a multiphase profile, the profiler must progress to the END state following segment BATCH LAST SEGMENT before cycling back to the BATCH FIRST SEGMENT. Once the profiler is ENDed, the automatic cycling function will change the profiler to the RUN state. The elapsed time of the profiler will continue running during recycling.
AUTO CYCLE COUNT	0-254	0: the profile (or batch) will repeat forever. 1-254: the profile (or batch) will repeat this many times.
EDIT PROFILE LOOPS	LOOP #1-4 FROM SEGMENT # 1-63 TO SEGMENT # 1-63 REPEAT COUNT 1-999	Define up to 4 loops per profile. Note that the repeat count is the number of loop repetitions, not the number of loop executions. See *Loop Segments* on page 184 for details.
JUMP FROM SEGMENT	0-63	The profile can be forced to jump from any segment to any other segment. A jump within a loop will continue that loop. A jump outside a loop will exhaust that loop. A jump outside the batch phase will exhaust any auto cycling in effect. At the completion of this segment, the profiler will jump to the beginning of JUMP TO SEGMENT.
JUMP TO SEGMENT	0-63	At the completion of JUMP FROM SEGMENT, the profiler will jump to the beginning of this segment.

Table 5-5 Edit Profile Prompts (continued)

Prompt	Range/Selections	Definition
TIME MULTIPLIER	Number	Time Multiplier determines the speed at which the profiler will run when in Fast Forward mode. It is used for testing the profiler's execution. See Fast Forward. When FAST FORWARD is ON(1), the profiler will run at a speed determined by the TIME MULTIPLIER parameter. Example The instrument is running at a 500msec scan rate. The TIME MULTIPLIER is set to 60. Therefore the profiler will run in (500msec x 60) or 30 second increments. Running a profiler in FAST FORWARD is a way to check for proper functioning of the profiler's events and outputs, without having to wait for the profiler to execute at its normal speed. See Figure 5-11.

Editing Segments

Use the following prompts to map out each segment's value, time, and events. Up to 63 segments are programmable per profile.

Table 5-6 Edit Segments Prompts

Prompt	Range/Selections	Definition
NEXT SEGMENT		Select this to edit the next segment.
PREVIOUS SEGMENT		Select this to edit the previous segment
VALUE	OFF or number	This prompt is active for soak segments and value/duration ramp types. Enter the value of the segment.
AUX VALUE	OFF or number	This value is an auxiliary soak output of the profile. The output is identified as SPn A1 and remains constant for the duration of the segment.
TIME	OFF or Positive number	The purpose of the number entered here depends on the ramp type of the profile. See *4 types of ramp segments* on page 178 for details.
GUAR SOAK #1	ON or OFF	ON means the profiler will Hold during this segment if deviation between PV #1 and the profiler output exceeds the guaranteed soak limits in Table 5-5. OFF means the profiler will not Hold during this segment due to deviation. See *Guaranteed Soak* on page 182 for details.
GUAR SOAK #2	ON or OFF	ON means the profiler will Hold during this segment if deviation between PV #2 and the profiler output exceeds the guaranteed soak limits in Table 5-5. OFF means the profiler will not Hold during this segment due to deviation. See *Guaranteed Soak* on page 182 for details.
EDIT EVENTS	EVENT #1 . . . EVENT #16	Enter the state of up to 16 discrete outputs of this segment. These outputs can be used to trigger any action requiring a discrete signal, such as a relay or another function block. An event stays on or off for the entire segment. To trigger events in the middle of a segment, you must divide the segment into 3 segments. See *Segment Events* on page 183 for details.

5.5 How to load and run a profiler

Overview

From the Setpoint Profile Trend's menu you can:

- load a profiler from memory
- load a profiler from storage media
- start a profiler
- hold a profiler
- reset a profiler
- advance a profiler
- shut down a profiler
- view profiler events
- view profiler details (profiler elapsed time, segment time remaining, profiler length in seconds, PV #2 value)
- edit profile segments,
- view various profiler displays.

All these tasks can be done using the front panel buttons shown in Figure 5-14. The procedures are explained in the next several pages.

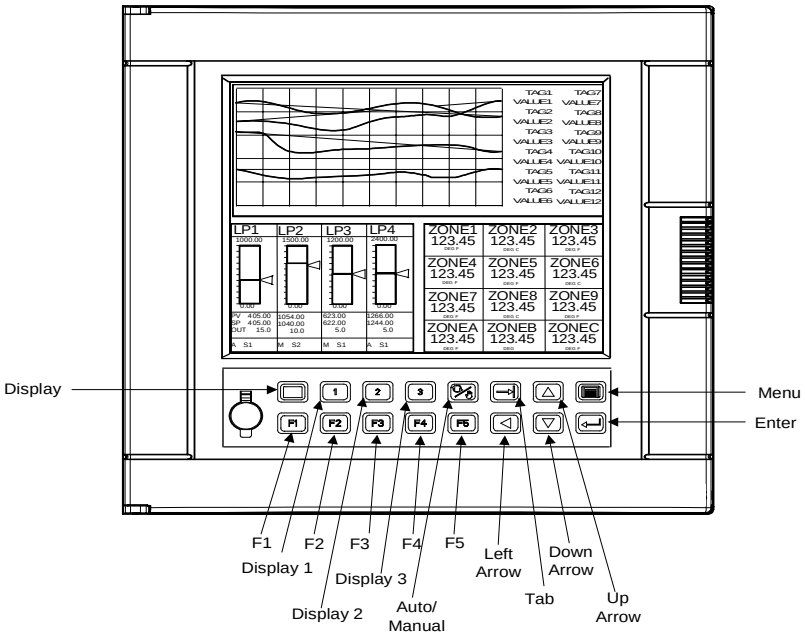


Figure 5-14 Buttons

ATTENTION

The following procedures assume the instrument has been programmed to display the Setpoint Profiler as a trend. To program displays, see section 4.18 Program Displays.

How to load programs from memory using Online menu

Programs stored in memory are identified by number (1-48) depending on instrument model number. Each program stored in memory contains one to four profiles, depending on your instrument. See Table 5-7.

For example, on an instrument with 3 profiles, you can store Program #1 which contains Profiles #1, #2, and #3.

Table 5-7 How Profiles Are Stored In Memory

1-programmer instrument 1 Profile per Program		2-programmer instrument 2 Profiles per Program		3-programmer instrument 3 Profiles per Program		4-programmer instrument 4 Profiles per Program	
This Program...	...contain this Profil	This Program...	...contain these Profiles	This Program...	...contains these Profiles	This Program...	...contain these Profiles
1	1	1	1	1	1	1	1
2	1		2		2		2
3	1	2	1		3		3
4	1		2	2	1		4
5	1	3	1		2	2	1
6	1		2		3		2
7	1	4	1	3	1		3
8	1		2		2		4
9	1	5	1		3	3	1
10	1		2	4	1		2
11	1	6	1		2		3
12	1		2		3		4
•		•		•		•	
•		•		•		•	
•		•		•		•	
45	1	23	1	•		12	1
46	1		2	16	1		2
47	1	24	1		2		3
48	1		2		3		4

Table 5-8 Procedure To Load A Program From Memory Using Online Menu

Step	Action	Result/Notes
1	Press the Display button to change to online mode.	An online display is shown.
2	Press the Menu button to display the online menu.	Online menu is displayed.
3	Press Decrement button to highlight Setpoint Profiles.	Cursor moves down.
4	Press Enter.	Setpoint Profiles menu is displayed.
5	Press Decrement button to highlight Load Program From Memory.	Prompt is highlighted.
6	Press Enter.	Load Program sub-menu is displayed.
7	Press Enter to select Program Number prompt.	Cursor moves to the right.
8	Press Increment or Decrement to select the desired program number to be loaded.	Program number is displayed.
9	Press Enter to select.	Program number is selected.
10	Press Enter again to load.	Program is loaded from the disk to the instrument.

Table 5-9 Procedure To Load A Program From Memory Using Point/Detail Menu

Step	Action	Result/Notes
1	Press the Display button to change to online mode.	An online display is shown.
2	Press the Tab button to display the Point/Detail menu.	Online menu is displayed.
3	Press Decrement button to highlight Setpoint Profiles.	Cursor moves down.
4	Press Enter.	Setpoint Profiles menu is displayed.
5	Press Decrement button to highlight Load Program From Memory.	Prompt is highlighted.
6	Press Enter.	Load Program sub-menu is displayed.
7	Press Enter to select Program Number prompt.	Cursor moves to the right.
8	Press Increment or Decrement to select the desired program number to be loaded.	Program number is displayed.
9	Press Enter to select.	Program number is selected.
10	Press Enter again to load.	Program is loaded from the disk to the instrument.

How programs are stored on a disk

Programs are saved to disk as a file name, number, and .LNS extension. Unlike memory storage, you can specify which profiles you want stored as a program. Disk capacity depends on the number of profiles in the program. See Table 5-11.

For example, on a 4 Programmer instrument, if you want to store Profiles #2, #3, and #4 as a program, you enter 2 at the prompt STARTING PROFILE #, to indicate that the lowest numbered profile to be stored will be Profile #2. At the prompt NUMBER OF PROFILES, you enter 3 to indicate that 3 profiles will be stored. Table 5-10 shows all possible combinations of profiles that can be stored to disk.

Table 5-10 How Profiles Are Stored On Disk

1 Programmer Instrumer 1 Profile per Program			2 Programmer Instrument Up to 2 Profiles per Prograr			3 Programmer Instrument Up to 3 Profiles per Progra			4 Programmer Instrument Up to 4 Profiles per Progra		
Startir Profile #	Numb r of Profile	Progra n contai s this profile	Startin Profile	Numb of Profile	Program contains these profiles	Startin Profile	Numb of Profile	Program contains these profiles	Starti g Profil #	Numbe of Profiles	Program contains these profiles
1	1	1	1	1	1	1	1	1	1	1	1
			2	1	2	2	1	2	2	1	2
			1	2	1, 2	3	1	3	3	1	3
						1	2	1, 2	4	1	4
						2	2	2, 3	1	2	1, 2
						1	3	1, 2, 3	2	2	2, 3
									3	2	3, 4
									1	3	1, 2, 3
									2	3	2, 3, 4
									1	4	1, 2, 3, 4

Table 5-11 Disk Program Capacity

Number of Profiles in Program	Maximum Disk Capacity
1	224 programs
2	199 programs
3	138 programs
4	100 programs

How to load a program from disk

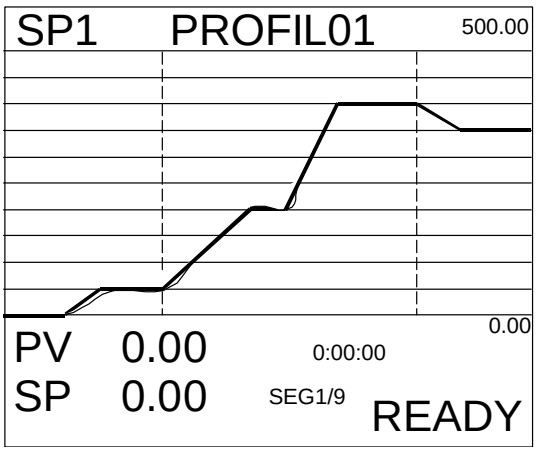
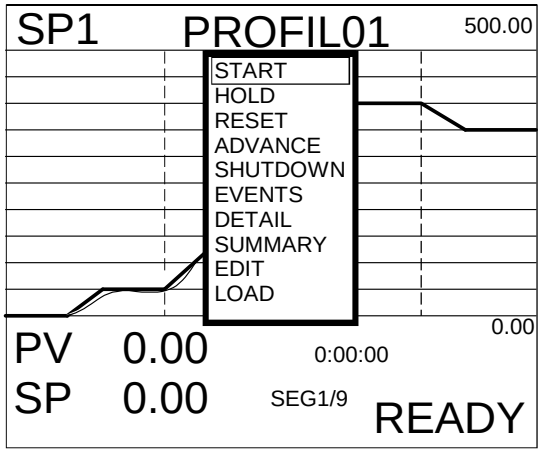
Table 5-12 Procedure To Load A Program From Disk

Step	Action	Result/Notes
1	Press the Display button to change to online mode.	An online display is shown.
2	Press the Menu button to display the online menu.	Online menu is displayed.
3	Press Decrement button to highlight Setpoint Profiles.	Cursor moves down.
4	Press Enter.	Setpoint Profiles menu is displayed.
5	Press Decrement button to highlight Load Program From Disk.	Prompt is highlighted.
6	Press Enter.	Load Program sub-menu is displayed.
7	Press Increment or Decrement to highlight desired program file.	Program is highlighted.
8	Press Enter to select. Press Enter again to load.	Program is loaded from the disk to the instrument.

How to start a profiler

A profiler can be started from the Ready, Hold or End state.

Table 5-13 Profiler Starting Procedure

Step	Action	Result/Notes
1	Press Display button until the Setpoint Trend is displayed.	
2	Press Tab button to display the profile menu.	
3	Cursor is on Start. Press Enter.	Profiler starts running at segment #1 if in Ready or End or resumes running from its Hold state. If in Ready state and Hot Start has been activated, profiler will start at the first point in the profile where the present value of PV #1 occurs. Event outputs assume their states as of the beginning of the running segment. Profiler status on lower right of display indicates RUN after you start the profiler.

ATTENTION

A profile can also be started by pressing the F1 button, but only if that profile's START parameter was configured as SY1 F1. See Section 5.4.

How to hold a profiler

Table 5-14 Profiler Hold Procedure

Step	Action	Result/Notes
1	Perform steps 1 and 2 from Start procedure (Table 5-13).	Profile menu is displayed.
2	Press Decrement button to move cursor to Hold. Press Enter.	The profiler is held at its present value and the segment's events are frozen. Elapsed time continues. Run time stops. Events are held at their current states.

ATTENTION

A profile can also be put on HOLD by pressing the F2 button, but only if that profile's HOLD parameter was configured as SY1 F2. See Section 5.4.

How to reset a profiler

Table 5-15 Profiler Reset Procedure

Step	Action	Result/Notes
1	Place profiler in Hold.	See Profiler Hold procedure inTable 5-14.
1	Perform steps 1 and 2 from Start procedure (Table 5-13).	Profile menu is displayed.
2	Press Decrement button to move cursor to Reset. Press Enter.	Profiler is reset to segment #1. All profiler timers are reset. All events go OFF. Profiler output goes to starting value of segment #1.

ATTENTION

A profile can also be RESET by pressing the F3 button, but only if that profile's RESET/RUN parameter was configured as SY1 F3. See Section 5.4.

How to advance a profiler to the next segment

Table 5-16 Profiler Advance Procedure

Step	Action	Result/Notes
1	Place profiler in Hold.	See Profiler Hold procedure inTable 5-14.
2	Press Decrement button to move cursor to Advance. Press Enter.	Profiler advances to next segment. Each press of Enter advances the profiler one segment. If at the last segment, the profiler advances to the first segment. If it is a multiphase profile, the profiler advances within the batch phase only. Events assume their segment states.
3	To resume running the profiler, select Start.	Profile resumes running from the new segment.

How to shut down a profiler

Table 5-17 Profiler Shutdown Procedure

Step	Action	Result/Notes
1	Place profiler in Hold by performing Profiler holding procedure (Table 5-14).	See Profiler Hold procedure in Table 5-14.
2	Press Decrement button to move cursor to Shutdown. Press Enter.	Profiler advances to the shutdown phase.
3	To resume running the profiler, select Start.	Profile resumes running from the beginning of the shutdown phase.

How to view event status

Table 5-18 Event Viewing Procedure

Step	Action	Result/Notes
1	Perform steps 1 and 2 from Start procedure (Table 5-13).	Profile menu is displayed.
2	Press Decrement button to move cursor to Events. Press Enter.	Live On/Off status of all 16 events are displayed. If Events change status, they do so at the beginning of the segment and Hold the status during the entire segment. EVENTS 1-ON 9-OFF 2-ON 10-OFF 3-OFF 11-OFF 4-OFF 12-OFF 5-OFF 13-OFF 6-OFF 14-OFF 7-OFF 15-OFF 8-OFF 16-OFF

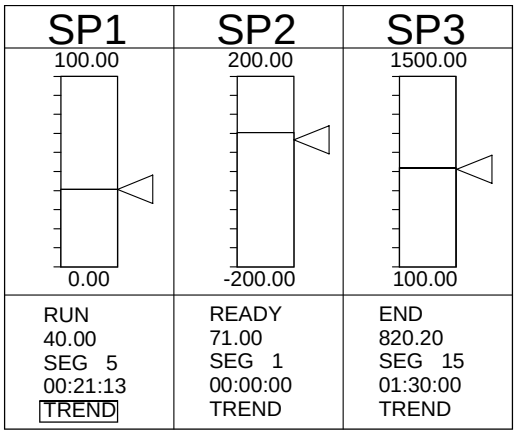
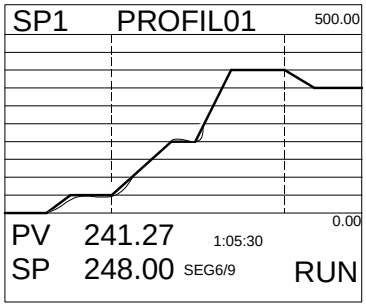
How to view profiler details

Table 5-19 Details Viewing Procedure

Step	Action	Result/Notes
1	Perform steps 1 and 2 from Start procedure (Table 5-13).	Profiler menu is displayed.
2	Press Decrement button to move cursor to Detail. Press Enter.	Shows: • Elapsed time since profile was started, including time spent in Hold. • Segment time remaining. • Profile length in seconds. • PV #2 value. PV #2 538.67 ELAPSED TIME 1:10:56 STIME REMAIN 0:09:10 LENGTH (SECS) 3900

How to view profiler summary display

Table 5-20 Summary Viewing Procedure

Step	Action	Result/Notes
1	Perform steps 1 and 2 from Start procedure (Table 5-13).	Profiler menu is displayed.
2	Press Decrement button to move cursor to Summary. Press Enter.	Three profilers will be displayed as bar graphs. Data for your profile(s) will be displayed.  **Setpoint Profiler 3 Bar Summary (SPP_3BS)**
3	Press the Tab button to move the cursor to the TREND of the desired profiler, then press Enter.	The profiler trend of the selected profile is displayed. 

How to edit a profile's segments

Profile may be in Run, Ready, End, or Hold to edit segments.

CAUTION

For value duration ramp type, it is recommended you do not edit the currently running segment or the next segment. Doing so may prematurely terminate the segment, that is, the profiler may jump to the next segment.

Table 5-21 Segment Editing Procedure

Step	Action	Result/Notes
1	Perform steps 1 and 2 from Start procedure (Table 5-13).	Profiler menu is displayed.
2	Press Decrement button to move cursor to Edit. Press Enter.	The Edit Profile menu is displayed: **EDIT PROFILE #n** **SEGMENT #n** **NEXT SEGMENT** **PREVIOUS SEGMENT** **VALUE 100.00** **AUX VALUE 50.00** **TIME 20.000** The profile and segment numbers whose value and time you are editing are shown.
3	Use Increment and Decrement buttons to move cursor to value or time. Press Enter to access the numbers shown. Change the numbers with the Increment and Decrement buttons.	Numbers are changed to their new values.
4	Press Menu button when finished editing segments.	The Profile Trend is displayed with the new segments.

6. Online Operations Using Primary Displays

6.1 Overview

Online operation using primary displays consists of using the buttons to view and interact with the displays that were assigned to the Display button. Pressing the Display button changes to online mode and accesses the displays assigned to this key. Available displays are shown in Figure 4-17 and are described in Table 6-1. In the following table, *interactive* means the Tab key can be pressed to access various functions on the display.

Table 6-1 Displays Accessed With Display Button

Display	Definition	Function	Interactive or view only?
V_TREND	Vertical trend	Displays up to 12 points trended vertically.	Interactive
VTRNDDIG	Vertical Trend Digital	Displays up to 12 points.	Interactive
VT_6DIV	Vertical Trend w/6 Divisions	Displays up to 12 points.	Interactive
H_TREND	Horizontal trend	Displays up to 12 points trended horizontally.	Interactive
HTRNDDIG	Horizontal Trend Digital	Displays 12 points trended horizontally.	Interactive
HTRNDBAR	Horizontal Trend Bar	Displays up to 12 points trended horizontally with 4 vertical bar graphs to the right. BAR GRAPH1 = Trend Point 1 BAR GRAPH2 = Trend Point 2 BAR GRAPH3 = Trend Point 3 BAR GRAPH4 = Trend Point 4	Interactive
V_4_BAR	4-point Vertical Bar Graph	Displays 4 points.	View only
V_6_BAR	6-point Vertical Bar Graph	Displays 6 points.	View only
V_8_BAR	8-point Vertical Bar Graph	Displays 8 points.	View only
V_12_BAR	12-point Vertical Bar Graph	Displays 12 points.	View only
H_4_BAR	4-point Horizontal Bar Graph	Displays 4 points.	View only
H_6_BAR	6-point Horizontal Bar Graph	Displays 6 points.	View only
PANEL_4	4-point Panel	Displays 4 points.	View only
UNIT DATA	Unit Data	Displays up to 12 point values at a time.	View only
PANMETER	Panel Meter	Displays up to 12 different panel displays.	View only
ALARMSUM	Alarm Summary	Displays current alarms.	Interactive
STORAGE	Storage Status	Displays data storage status.	View only
TOTALIZR	Totalizer	Displays all totalizer values.	View only
LOOP_BAR	Loop w/Bar Graph	Displays a loop's data as numbers and bar graphs.	Interactive
LOOP_DIG	Digital Loop	Displays loop data as numbers only.	Interactive
LOOP_2BS	Loop w/2 Bar Graphs	Displays 2 Loops' data as bar graphs.	Interactive
LOOP_3BS	Loop w/3 Bar Graphs	Displays 3 Loops' data as bar graphs.	Interactive
LOOP_4BS	Loop w/4 Bar Graphs	Displays 4 Loops' data as bar graphs.	Interactive
LOOP_8BS	Loop w/8 Bar Graphs	Displays 8 Loops' data as bar graphs.	Interactive
SPP_2BS	Setpoint Profiles w/2 Bar Graphs	Displays 2 Profiles' data as bar graphs.	Interactive
SPP_3BS	Setpoint Profiles w/3 Bar Graphs	Displays 3 Profiles' data as bar graphs.	Interactive
SPP_4BS	Setpoint Profiles w/4 Bar Graphs	Displays 4 Profiles' data as bar graphs.	Interactive
SP_TREND	Setpoint Profile Trend	Displays a Profile as a Trend.	Interactive
TOTAL	Totalizer	Displays 1 totalizer	View only

6.2 Interacting With Primary Displays

Interacting with Setpoint Trend Display

When a Setpoint Trend display is shown (Figure 6-1), press the Tab key to display options for controlling the profilers execution. See Section 5.5 for details.

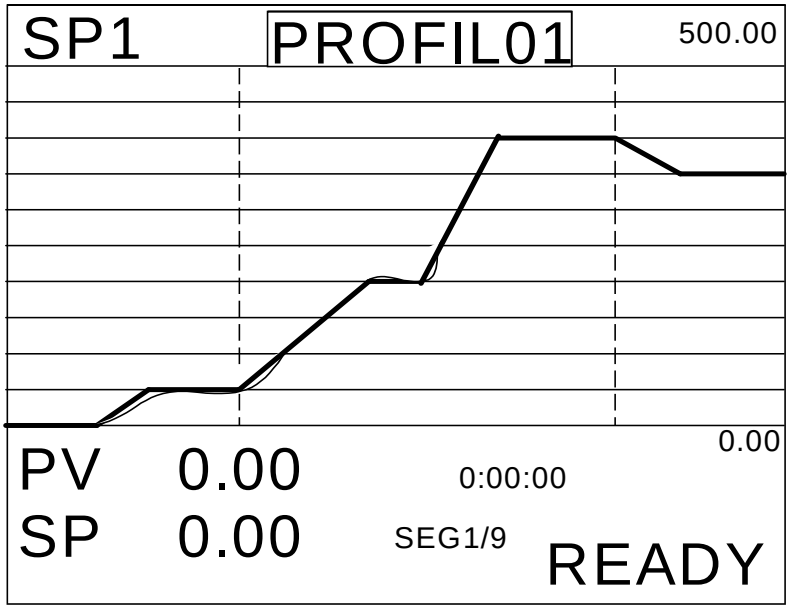


Figure 6-1 Changing Profile Batch Tag

Interacting with Live or Replay Trends

With a live vertical or horizontal trend on the display, press Tab key to access the Point/Detail menu. When replaying (stored) trends this menu is always displayed. From this menu you can press the Tab key again to advance the scoreboard at the top of the display to the next point in the trend. Also, you can press the Increment or Decrement buttons to scroll the trend forward or backward in time.

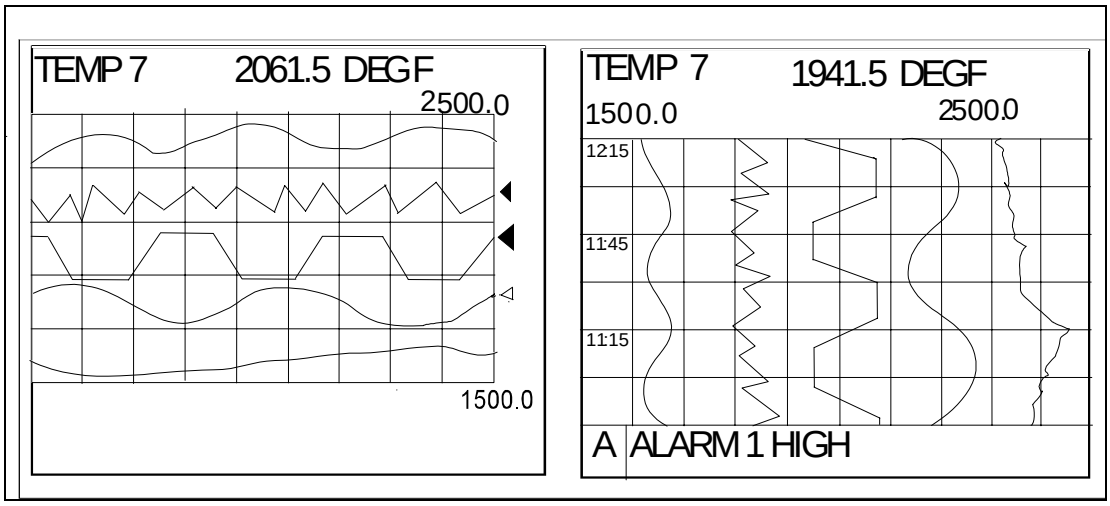


Figure 6-2 Horizontal and Vertical Trend Displays

Table 6-2 Point/Detail Menu Prompts

Prompt	Definition
SCROLL	Press the Increment or Decrement buttons to scroll the trend forward or backward in time. Press Tab key to change to the next point on a multi-point trend. Press the Menu button to restore the Point/Detail menu. The trend display will remain at the time determined by the SCROLL. Press the Display button to restore the original primary display and cancel the SCROLL.
SET HOLD, REL HOLD	Causes one point to remain displayed in the scoreboard. Available for live trend only. Before selecting SET HOLD, press Point/Detail to change the scoreboard to the desired point. Select SET HOLD and press Enter. An “H” appears in the lower right display. The HOLD will remain in effect until deliberately removed with REL HOLD. To HOLD a different point, press the Tab key until the desired point is shown, then press the Display button. To release the HOLD, select REL HOLD.
DETAIL	Use the Increment and Decrement buttons to move the line cursor forward or backward in time. The value of the displayed point will change to its value at the new time. If desired, press Tab to change to the next point on a multi-point trend. Press the Menu button to restore the Point/Detail menu. The trend display will remain at the chosen point. Press the Display button to restore the primary display and cancel DETAIL feature.

Table 6-2 Point/Detail Menu Prompts (continued)

Prompt	Definition
FIND	Lets you display the trend from a certain time. A list of times will appear on the display, as shown. FIRST is the oldest time available in the trend. LAST is the most recent time available. FIRST: JAN 1 1994 12:00 LAST: JAN 5 1994 13:00 FIND: JAN 1 1994 12:00 Select month, day, year, hour and minute. To cancel the search, press Display, Menu, Display1, Display2 or Display3 buttons. When the data has been found, the selected time/date will appear in the center of the trend area. The Point/Detail menu will also appear.
ZOOM	Lets you magnify (zoom) the displayed scale. Press the Increment and Decrement buttons to select the amount of magnification, shown in the lower right corner of the display. Note that the size of the Zoom cursor changes accordingly. See Figure 6-3. OFF – uses point's trend display limits (turns Zoom off) 2X – uses half of point's trend display limits 4X – uses one fourth of point's trend display limits FULL – uses point's programmed limits (not its trend display limits) Press the Tab key to select the point/trace to be zoomed (magnified). Press Enter to display the magnified trend. The Point/Detail menu is displayed to allow further analysis. Press the Display button to restore the primary display with the ZOOM limits. A "Z" appears in the lower right of the display.
TIMEBASE	Lets you change the timebase of the trend. Choices are: NORMAL – use the trend's normal timebase. ALTERN (Alternate) – use the trend's alternate timebase. Move the cursor box to the desired timebase and press Enter. The trend will be redisplayed in the new timebase. An arrow points to the current timebase. Timebases are specified in the program mode. Available for live trends only. If a storage trend CHANGE WITH KEY is set to YES, then changing the timebase will also change the storage rate of the storage trend. That is, if the live Trend1 is displayed in NORMAL timebase, then the storage Trend1 will be stored at the LOW rate. If the live Trend1 is displayed in the ALTERN timebase, then the storage Trend1 will be stored at the HIGH rate. Trend2, 3 and 4 behave the same way.
NEW FILE	Select to see the Replay From Disk menu, from which you may select another stored file for replay. Available for replay trends only.

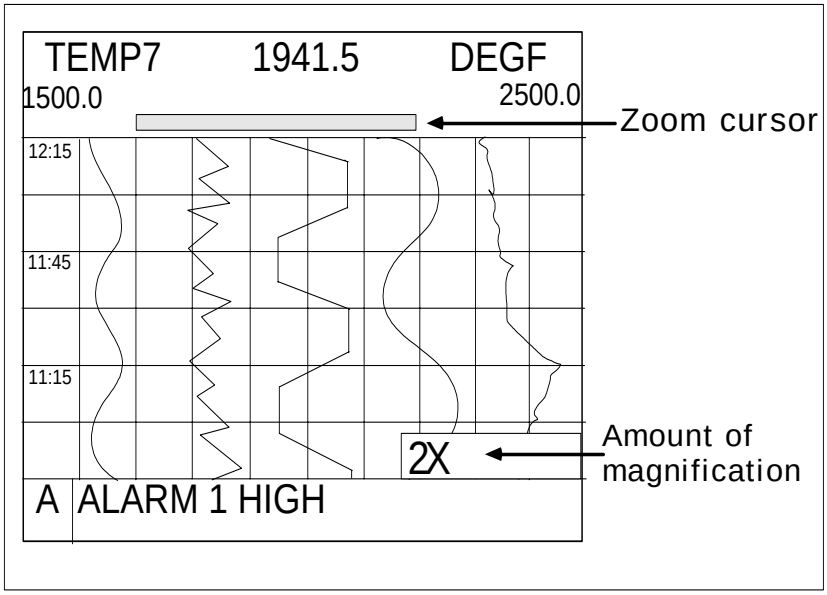


Figure 6-3 Vertical Trend at 2X Zoom

Interacting with Panel_4 Display

To stop the rotation of the panel display on a precise point series, follow the procedure in Table 6-3.

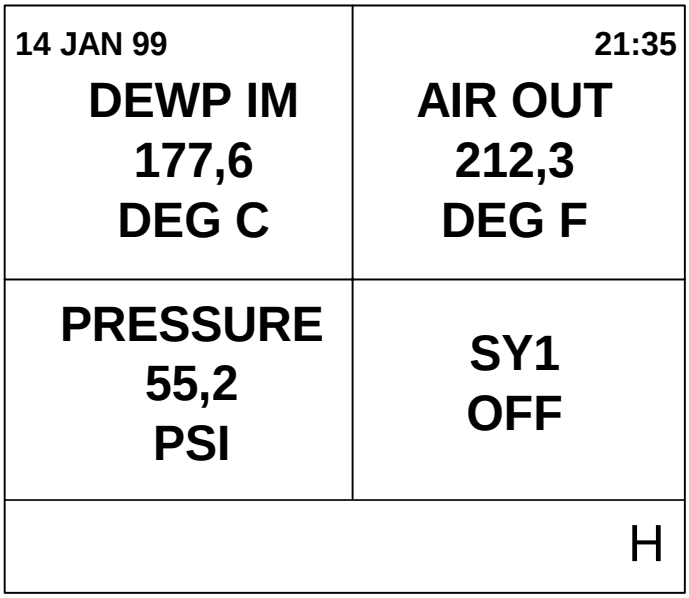


Figure 6-4 Panel Display

Table 6-3 Stop Panel_4 Display Rotation Procedure

Step	Action	Result
1	Press Tab key	Displays menu item SET HOLD at the lower right hand corner of the display.
2	Press Tab key	Displays the desired point series.
3	Press Enter	Holds display on desired point series. An “H” appears in the lower right of the display.

To resume rotation through all points, follow the procedure in Table 6-4.

Table 6-4 Resume Panel_4 Display Rotation Procedure

Step	Action	Result
1	Press Tab key	Displays menu item REL HOLD at the lower right hand corner of the display.
2	Press Enter	The “H” disappears and rotation resumes.

Interacting with Loop Displays

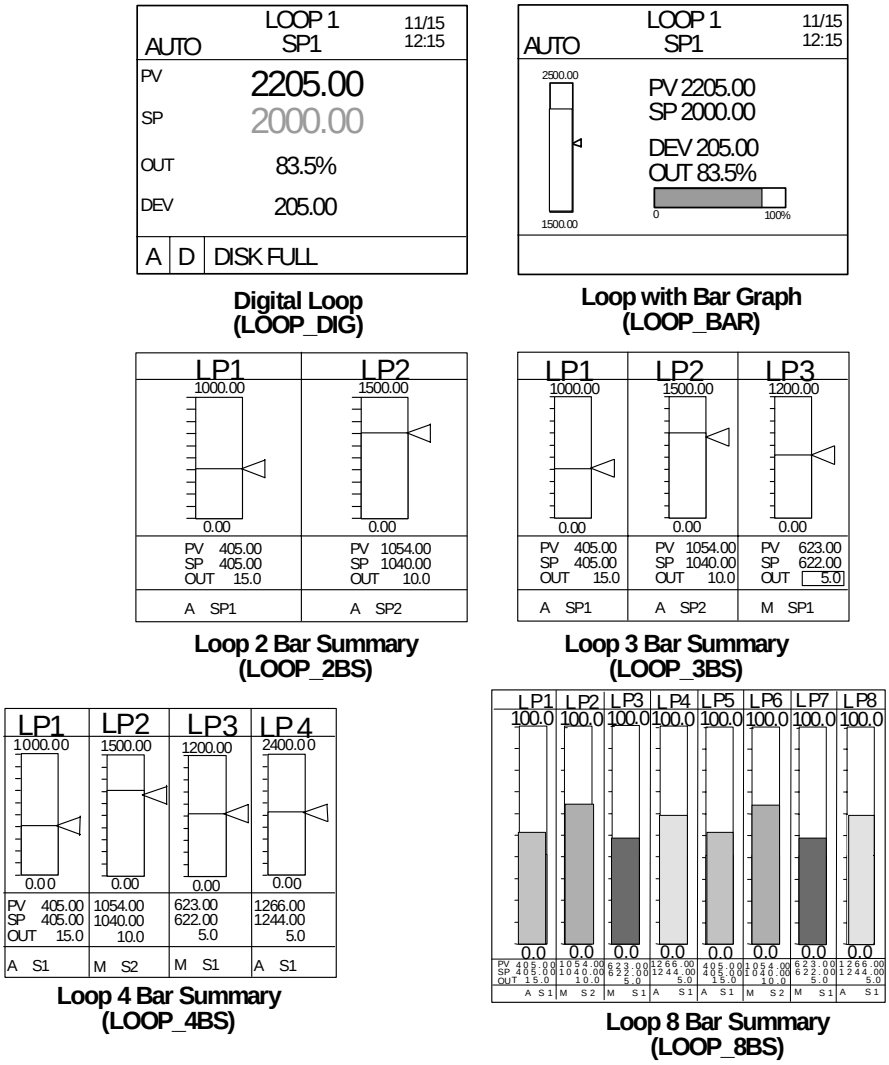


Figure 6-5 Loop Displays

When the Loop w/Bar Graph, Loop 2 Bar, Loop 3 Bar, Loop 4 Bar, Loop 8 Bar or Digital Loop display is shown you can:

- select Auto or Manual control mode for the loop,
- change loop output,
- change the setpoint value,
- switch to the Loop Tuning display for Setpoint 1/.Setpoint 2 toggle (for tuning parameters and pretuning).

Detailed instructions for performing these interactions are described in Table 6-5.

Table 6-5 Interacting With Loop Displays

To perform this action	Do these steps
Move the cursor box to another area of the display	Press the Tab key to move the cursor to the Loop Tag at the top of the display, then to the setpoint value, then to the loop output value (if loop is in Manual mode).
Toggle the loop between Auto and Manual modes	Press Auto/Manual button. To use the Auto/Manual button all of the following conditions must be met. 1. Loop must be in Local mode, which means FORCE REMOTE MAN discrete parameter must be OFF. 2. DISCR VS KEY SEL discrete parameter must be OFF. 3. If security is active for AUTO/MAN changes, the security code must be entered first. For a description of the loop parameters FORCE REMOTE MAN and DISCR VS KEY SEL, see Table 4-10.
Lower or raise the loop output (displayed as %).	Press Tab key to move cursor to loop output. To change the output, the loop must be in manual mode (initiated by front panel key or by external discrete signal)– ***not*** in Remote Manual mode.
Increase or decrease Setpoint value	Press Tab key until cursor is on the setpoint value. Press Increment and Decrement to adjust value. Only numerically assigned setpoint values can be changed online; Setpoint #2 cannot be changed if it is acting as a remote setpoint (e.g. running a profile). You can also change the setpoint value by accessing the Tune Loop menu as described in the next row.
Access the loop tuning parameters	Press Tab key until the cursor is on the loop tag at the top of the display. Press Enter to access the Tune Loop menu for that loop. Adjust desired parameters. To return to the loop display, press Menu. See Section 7.6 Tune Loop.

6.3 Display Messages and Symbols

Overview

Messages and symbols will appear in different areas of the display to inform the operator of a variety of conditions. The area across the bottom of the display (Figure 6-6) is reserved for messages that require the operator to take action. They include Active Alarm Symbols, Diagnostic Messages, and Data Storage Messages.

Location

The Alarm and Diagnostic messages consist of a symbol on the left side of the display and a text message next to it on the right. The Data Storage message has no symbol and includes only the text portion.

Multiple messages

If multiple messages are present simultaneously, they will be arranged in a “cascaded” or “shingled” arrangement, so that underlying symbols will be visible (data storage on top, diagnostics in the middle, alarms on bottom).

Example of primary display

Figure 6-6 shows an example of a primary display.

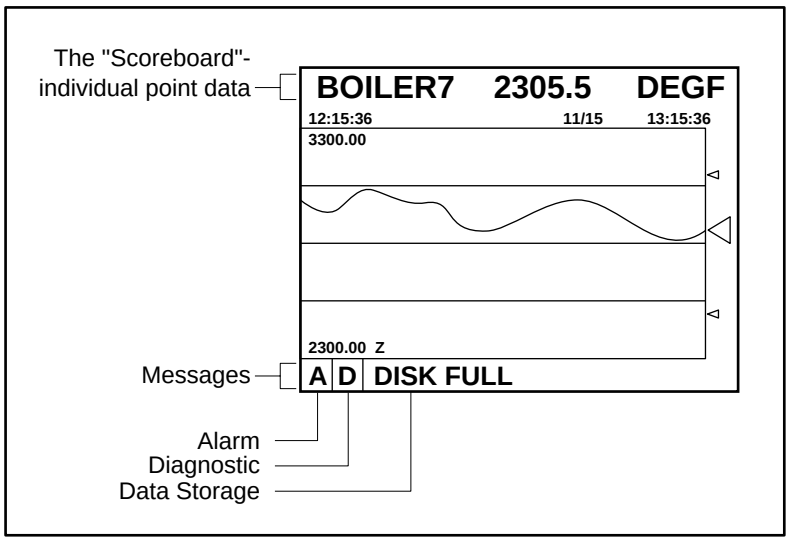


Figure 6-6 Example of Primary Display

Description of Messages and Symbols

Table 6-6 Messages and Symbols at Bottom of Display

Message/Symbol	Color	Description
A followed by text description of alarm	Red	An active alarm exists. Flashes while unacknowledged. When the operator acknowledges the alarm, the flashing will stop. The symbol and text will remain until the alarm has cleared.
D followed by text description of diagnostic	Blue	A diagnostic error has been detected. Flashes while unacknowledged. The symbol and text will remain until the operator acknowledges or deletes the diagnostic in the online Access Summaries menu.
Data Storage Messages	**Color**	**Description (shown low to high priority)**
UPDATING DISK	Yellow	Instrument is flushing all buffered data to the disk.
CHECKING DISK	Yellow	Whenever the front panel has been opened and closed, the instrument checks that a properly formatted disk is installed and ready to receive data.
INITIALIZING	Yellow	Initialization is in progress.
DS INIT FAILED	Yellow	Initialization failed. Possible reasons: disk has not been formatted, is write-protected, or is defective.
STORAGE FULL	Yellow	Less than 5 minutes of space remains in the internal buffer. Data is accumulating in the internal buffer (temporary storage) because it is unable to store the data on the floppy disk. Possible reasons include: • Disk is full and storage is programmed as non-rollover. • There is no disk in the drive. • The disk is write-protected. • The operator is in the process of retrieving stored data from the disk. • The disk is "not current" (see DSK NOT CURRENT below). • The front bezel is open. The message will disappear when the condition is corrected, or if data storage is disabled (turned off).
DISK FULL	Yellow	No more space is available on one or more of the files on the floppy disk for storage of data as programmed. This message will appear only if at least one partition on the disk is programmed for non-rollover operation. The message will disappear when a new disk is initialized, or if data storage is disabled (turned off).
DISK WARNING	Yellow	Floppy disk is not full but available space on one or more disk files has reached the programmed warning limit. The message will disappear when a new disk is initialized, or if data storage is disabled (turned off).
BEZEL OPEN	Yellow	Instrument front panel is open or is not closed securely.
DISK ERROR	Yellow	The instrument is attempting to store data but the disk is either not properly formatted or is faulty. The message disappears when the disk is formatted or replaced, or if data storage is disabled (turned off).
DSK NOT CURRENT	Yellow	When a disk is initialized the instrument marks it as the "current" disk. The instrument will only store data to the "current" disk. If any other disk is placed in the drive this message will appear. The message will disappear when the "current" disk is inserted or a new disk is initialized.
WRITE-PROTECTED	Yellow	The disk in the drive has its write-protected tab set to the protect position.
DISK MISSING	Yellow	Data storage is enabled, but no disk is installed in the disk drive.

Table 6-6 Messages and Symbols at Bottom of Display (continued)

Message/Symbol	Color	Description
GENERAL ERROR	Yellow	This message will appear if the instrument encounters any error not mentioned above.
S	Yellow	Located in bottom right of display. Indicates storage is active data is being collected on disk or in the instrument's internal buffer.
Z	White	Located in bottom right of display. The display's upper and lower limits are zoomed on a smaller range. Disappears when Zoom is turned off.
H	White	Located in bottom right of display. Indicates the display is held on a single data point and is not rotating through all data points. Disappears when Point Hold is removed.

Table 6-7 Messages and Symbols Elsewhere on Display

Message/Symbol	Color	Description
REVIEW or REPLAY	White	Trend Replay/Review. Adjacent to detailed point information (scoreboard) on the screen. Indicates that the trend on the display is from historical data and does not represent the current state of the process. REVIEW means that the data for the trend are from current memory (RAM). REPLAY means that the data are retrieved from floppy disk (data storage).
*	White	Analog Input Value Adjust. Located to the right of the data point value. This message appears only on the AI Value Adjust display. It indicates that a bias has been manually applied to the value of the particular data point. The symbol will disappear when the value is set to OFF.
◥	Red	Low Alarm Setpoint. Located above vertical trends, right of horizontal trends, along side of bar graph. These symbols appear automatically if a displayed point is the input to one or more Alarm function blocks. The first 4 low type alarm blocks using the displayed points are represented by these symbols.
◢ or ◥	Red	High Alarm Setpoint. Located above vertical trends, right of horizontal trends, or along side of bar graph. These symbols appear automatically if a displayed point is the input to one or more Alarm function blocks. The first 4 high type alarm blocks using the displayed points are represented by these symbols.
Flashing between ****** and value	Same as data point	Bad Input Values. Appears in place of the value on all displays. Value is outside the programmed limits. Caused by an upstream AI failure (AI is open circuit and failsafe or is type linear and outside its programmed range by 10% or more).
Flashing between value and blank	Same as data point	Questionable Input Values. Appears in place of the value on all displays. Value is clamped at its limit.
Flashing between value and blank	Same as data point	Output Limits of Totalizer or Interval Timer Exceeded. Appears in place of the value on all displays. Interval Timer 's or Totalizer's value is outside its output limits. Value is not clamped.

7. Online Operation Using Menus

7.1 Overview

Online operation involves interacting with displays and with menus. This section describes how to interact with the online menus.

The Online Menu is accessed by pressing the Display button, then the Menu button. Or, you can choose SET MODE from any menu to change the mode.

ATTENTION

Switching to the Online mode from the Program or Maintenance modes by pressing the Display button, sometimes displays incorrect data for a few seconds before the display data is refreshed. You can avoid this distraction by selecting ONLINE from the SET MODE menu instead.

The top level of the menu structure is shown in Table 7-1. Your unit may have a reduced menu if options are not present or if features have been disabled through programming selections.

Table 7-1 Online Main Menu

Menu as displayed	Function
SET MODE	Change instrument's operating mode
DATA STORAGE	Set up, operate and view the status of the data storage
ACCESS SUMMARIES	Display status summaries
DATA ENTRY	Adjust function values and states
SETPOINT PROFILES	Edit profile parameters. Store and load programs.
TUNE LOOP	Enter loop tuning values. Pretune loop.
SET ANALOG OUTPUTS	Adjust Analog Output values
REVIEW PROGRAMMING	View all programming (read only)

7.2 Data Storage

Overview

Data Storage lets you store trend data, unit data, alarms, events, and diagnostics for later review onscreen or on a PC with SDA software or the TrendManager Pro V5 software suite. Setup and configuration of Data Storage is described in Section 4.26; online operation is described here.

Typical online data storage tasks

1. Removing, installing, and labeling disks.
2. Pre-initializing a disk on a PC (see Section 3.15)
3. Initializing new disk using the current Data Storage setup schedules.
4. Checking current storage setup.
5. Starting and stopping storage (3 methods):

   a) Start/stop all storage via ENABLE STORAGE menu.

   b) Start/stop a particular storage file's storage via its external enable discrete.

   c) Start/stop all storage batches via BATCH STATE menu item or via BATCH CONTROL discrete.
6. Checking storage status with DATA STORAGE STATUS display.
7. Replaying data stored on disk.
8. Reading data storage messages.

Installing a disk

The disk should be pre-initialized. Pre-initializing may be done at a PC or in the instrument with DATA STORAGE menu item INITIALIZE DISK. Maintaining a stock of several formatted disks is recommended to minimize maintenance time on the instrument.

Disks are inserted and removed from the front panel as described in Table 7-2.

Table 7-2 Floppy Disk Insertion/Removal Procedure

Step	Action
1	Open the door.
2	Insert the disk into the slot until it catches in place.
3	To remove the disk, press the rectangular button next to the slot. Be sure to label the contents of each disk.
4	Close the door.

How data is stored

To provide continuity of storage when the disk is removed, the data storage feature buffers data internally for a period of time based on the storage rate and amount of storage data. Since storage files and Setpoint program files may not be stored on the same disk, you can swap the storage disk with a configuration disk for up to the buffered data time period while loading Setpoint programs without losing storage data. When the storage disk is re-installed, or when another disk is initialized using the current schedules, the buffered data will be transferred to the disk.

Initializing a disk

Initialization creates separate areas on the disk for each type of data to be stored. Data types that can be stored are up to 3 Trends, Alarms, Events, Diagnostics, and Unit Data. You can initialize a disk using the current storage schedule or using a new storage schedule.

When data storage is active, the instrument determines the status of the disk. Status can be one of the following possibilities.

Table 7-3 Disk Status

Disk status	Result
The “current” disk was inserted back into the drive.	The instrument will resume storage to this disk automatically.
Some other disk was inserted. That is, disk is blank, contains old data files or contains configuration files.	In this case, a DISK NOT CURRENT message is displayed and data is stored in a buffer, not on the disk.

Initializing a disk using the same storage setup

To continue storing the same data storage schedule on this disk, select the online DATA STORAGE SETUP menu, select INITIALIZE DISK, then select USE CURRENT SCHEDULES. The instrument will display a prompt asking for a yes or no response to initialize the disk. ***Initializing will destroy all existing information on the disk*.** To shorten the initialization time, the disk should be pre-initialized on a PC. With this prompt you can remove a disk inserted by mistake, or deliberately re-use an old disk containing useless information. If you answer YES, the current schedule will be established on the new disk, buffered data will be stored to the disk, and if any storage files are in batch mode, the batch counter will be reset to zero(0).

Initializing a disk using a new storage setup

If you change any part of data storage schedule and you want the changed (new) schedule’s data to be stored, select the online DATA STORAGE SETUP menu, select INITIALIZE DISK, then select USE NEW SCHEDULES. To shorten the initialization time, the disk should be pre-initialized on a PC. All data that was buffered since the previous disk was removed is lost. If you change the schedule but initialize using the current schedule, the changed (new) schedule is not stored.

Initialization errors

If an initialization error occurs, one of the following messages may appear.

Error message	Definition
BEZEL OPEN	Disk use is not permitted while the front panel bezel is open. The bezel must be closed and latched.
WRITE-PROTECTED	The write protect tab is set (open) on the floppy disk. The tab must be closed to permit data storage.
DISK ERRORS	The disk installed in the drive is faulty or is not a DOS formatted disk. It must be formatted before it can be initialized. Formatting can be performed on an IBM compatible PC or with the FORMAT DISK command in the Data Storage menu.
DISK IS MISSING	No disk is installed in the drive.

Checking current storage setup

To see what is being stored and when, select DATA STORAGE SETUP, then select REVIEW CURRENT SCHEDULES.

Starting and stopping storage

Data Storage can be started and stopped three ways. At the highest level, the ENABLE STORAGE menu item enables or disables all data storage. At the next highest level, EXTERNAL ENABLE enables or disables storage for each file type (Trends #1-3, Alarms, Events, Diagnostics, Unit Data). At the lowest level, storage for each file type is started and stopped with one of two controls: a menu item BATCH STATE or a discrete parameter BATCH CONTROL.

Table 7-4 describes each method of starting and stopping storage.

Table 7-4 Storage Start/Stop Controls

Prompt	Comments
ENABLE STORAGE	Acts as a master enable/disable switch for all data storage. Select this item from the DATA STORAGE menu. Set to ENABLE to allow storage of the current schedule. **If this is set to DISABLE, online data storage cannot take place, even if storage for individual files is enabled with EXTERNAL ENABLE.**
EXTERNAL ENABLE	Acts as a enable (high)/disable (low) switch for each storage file type (trends, alarms, events, diagnostics, unit data). Any storage file whose external enable is configured with a discrete will start and stop according to the state of that discrete. This works independently of batch storage.
BATCH STATE	Acts as a start/stop switch for each storage file type. The ENABLE STORAGE and EXTERNAL ENABLE both must be enabled for BATCH STATE to function. Accessed under DATA STORAGE menu. If batch storage mode is configured for any storage file and if BATCH CONTROL has not been configured with a discrete, then you can manually start/stop the batches using this selection. The instrument will automatically assign a number internally to identify the batch for storage. For example, data stored between the first start and stop is marked as Batch #1. When the next batch starts, the instrument will increment the batch number. These numbers identify the batches for later retrieval.
BATCH CONTROL	Accessed under SET UP NEW SCHEDULES. If this item is configured with a discrete, it will start and stop storage for all storage files configured with batch storage mode. The ENABLE STORAGE and EXTERNAL ENABLE both must be enabled for BATCH CONTROL to function. The instrument will automatically assign a number internally to identify the batch for storage. For example, data stored between the first start and stop is marked as Batch #1. When the next batch starts, the instrument will increment the batch number. These numbers identify the batches for later retrieval.
BATCH NUMBER	Accessed under DATA STORAGE. Shows the number (1-255) of the active batch. The batch number is assigned automatically by the instrument when the batch is started by either method (BATCH CONTROL or BATCH STATE).

Checking Data Storage Status

The Data Storage Status display is accessed from the Online data storage online menu. It is also accessed by pressing any display button, if the button has this display assigned to it. See Figure 7-1.

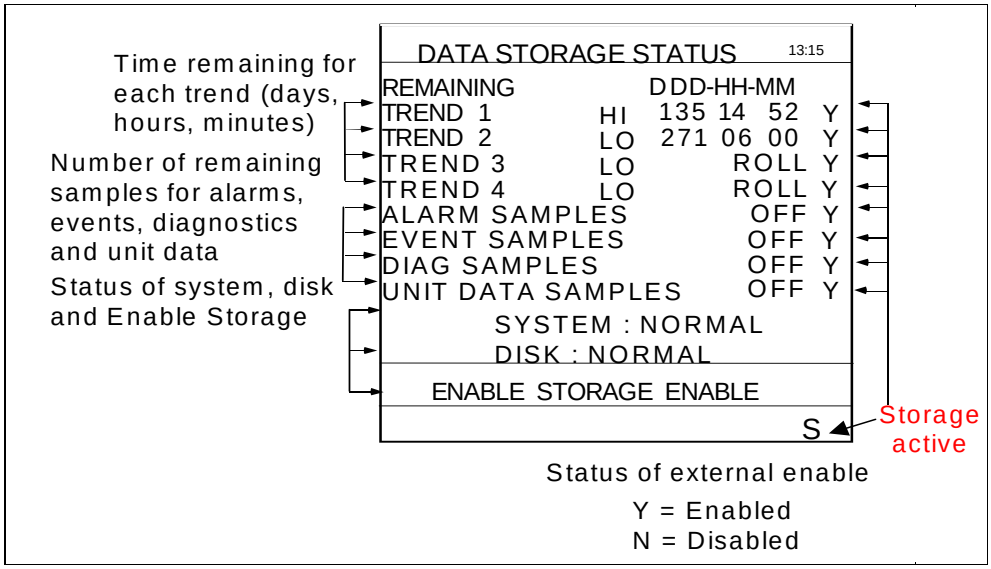


Figure 7-1 Data Storage Status Display

Replaying stored data

Data stored on floppy disks can be retrieved and displayed online at any time, whether data storage is active or not. All data is stored as individual files and is retrieved by filename. To retrieve a file from disk, follow the procedure in Table 7-5.

Table 7-5 Data Storage Replay Procedure

Step	Action
1	Insert the disk containing the desired file into the instrument.
2	Select DATA STORAGE and then REPLAY FROM DISK. A list of filenames of all the files on the disk will appear. The filename extension identifies the type of data in the file. Note: Events can only be replayed with SDA data analysis software. .LNT Trend .LNA Alarms .LNE Events .LND Diagnostics .LNU Unit Data
3	Select a start time within the first and last times. Data replay will begin at this time. For trends, select horizontal or vertical replay format and screen size (timebase).
4	Select Replay to view the data.

ATTENTION

If you are replaying data from a “non-current disk,” keep in mind that the instrument will continue acquiring data and holding it temporarily in its active memory (RAM) until you insert a proper disk for storage. If you spend too much time replaying data, the instrument could run out of active memory space. If this occurs, a storage full warning message will be displayed. See Tables 6-6 and 6-7 for an explanation of the various warning messages.

Examining replay data

For details on examining replay trend data, see Section 6.2, Interacting With Primary Displays. To examine replayed alarms, events, and diagnostics, use the Up Arrow or Down Arrow keys.

Reading Data Storage Messages

See Data Storage Messages in Table 6-6 for message descriptions.

7.3 Access Summaries

Summaries are available for all points, alarms and diagnostics in the instrument.

Display alarm summary

Alarms are set up as part of the instrument configuration procedure (Section 4.13). Up to 12 alarms can be configured.

An alarm can be assigned to any analog data point (Analog Input, Analog Output, or Calculated Value) and can be one of these types.

Alarm type	Function
HIGH	Alarm when input value ≥ setpoint value.
LOW	Alarm when input value ≤ setpoint value.
DEV (Deviation)	Alarm when input value deviates above or below compare point value by an amount ≥ setpoint value.
HRATE (High Rate)	Alarm when input value increases at rate ≥ setpoint value, in units per minute. Negative rate setpoints are processed as positive values. May take up to 30 seconds to activate.
LRATE (Low Rate)	Alarm when input value decreases at rate ≥ setpoint value, in units per minute. Negative rate setpoints are processed as positive values. May take up to 30 seconds to activate.

An alarm programmed with delay will not activate before its delay time. An alarm programmed with hysteresis will clear after its hysteresis delay.

The alarm will remain active as long as the conditions causing it remain. When the conditions no longer exist, the alarm will be “cleared” automatically. “Clear” means that the indicators for the particular alarm on all displays will be removed and the alarm will be removed from the Alarm Summary list.

What happens during an alarm

- A flashing red alarm indicator appears on the bottom of all screens. (The alarm must be acknowledged to stop the flashing.) On displays where the alarm point appears, the value is red and a red indicator appears.
- The alarm is entered into the active alarm summary which can be viewed at any time. The alarm summary contains the point identification, a description of the alarm, the sense (high, low rate, etc.), the time of occurrence and the current value of the point.
- When the alarm clears, the time of occurrence and the time of clearing will both be entered into the Alarm History, which is an ongoing record of the occurrence and clearing of all alarms.
- If so configured, the alarm occurrence will also be logged on a summary list stored on floppy disk (see Data Storage, section 4.26).
- If so configured, the alarm triggers a discrete output relay. The relay returns to normal state only when the alarm is cleared.

Acknowledging alarms

When an alarm occurs, it must be acknowledged by the operator to stop its indicator from flashing. Acknowledging an alarm **does not** clear the alarm. See Table 7-6for procedure.

Table 7-6 Alarm Acknowledgment Procedure

Step	Action
1	Select ACCESS SUMMARIES from online menu.
2	Select DISPLAY ALARM SUMMARY to display a list of active alarms. Up to 4 pages (14 alarms) can be listed. Unacknowledged alarms will be flashing. Use the Up Arrow and Down Arrow buttons to view the various pages of the display, as desired. Display Alarm Summary can also be accessed by pressing the Display button, if the Alarm Summary display was assigned to that button. See Section 4.18.
3	Press the Up Arrow or Down Arrow button and a cursor will appear on the display. Use the Up Arrow or Down Arrow button to position the cursor on a flashing alarm and press Enter to acknowledge the alarm. The flashing will stop and the cursor will disappear. If you do not press any button for a period of 5 seconds, the cursor will disappear. This is a safety feature, because while the cursor is visible on the display, the display is temporarily disabled and a new alarm will not be shown.
4	If there are more flashing alarms, press the Up Arrow and Down Arrow buttons to restore the cursor.

Display Alarm History

The Alarm History display is a multi-page display which lists information on cleared alarms. The most recent 25 cleared alarms will be shown, with the oldest being dropped from the list when a new alarm clears and is logged in.

The Alarm History includes the descriptor and tag identifiers of the alarm, the type (high, low, high rate, etc.), the setpoint value at the time the alarm occurred and the date and times of the occurrence and clearing of the alarm (designated as IN and OUT times, respectively).

Use the Up Arrow and Down Arrow buttons to view the various pages of the display, as desired.

Display Diagnostics

A Diagnostic is a displayed error message that indicates a serious error or failure has occurred. See Section 9 for diagnostic descriptions and possible causes.

What happens during a diagnostic

- A flashing blue diagnostic indicator will appear on the bottom of the screen.
- The diagnostic message will be entered into the diagnostic summary which can be viewed at any time. The summary contains each message and the date and time of occurrence.
- If Data Storage is set up accordingly, the diagnostic occurrence will also be logged on a summary list stored on floppy disk.
- The diagnostic summary can contain a maximum of 50 messages with the newest shown at the top of the list. As new diagnostics occur beyond 50, the oldest will be dropped from the list. Diagnostic messages are not automatically removed from the summary if the error condition is corrected. The list must be deleted from the screen periodically by the operator as described under Delete All Diagnostics.

Acknowledging Diagnostic Messages

When a diagnostic occurs, it must be acknowledged by the operator to stop its indicator from flashing. See Table 7-7.

Acknowledging a diagnostic only stops its indicator from flashing; it does not correct the cause of the diagnostic. You are not required to acknowledge a diagnostic. The flashing can also be stopped if all diagnostics are erased, using the DELETE ALL DIAGNOSTICS menu selection.

Table 7-7 Diagnostic Acknowledgment Procedure

Step	Action
1	Select ACCESS SUMMARIES from the main online menu.
2	Select DISPLAY DIAGNOSTICS to display a list of diagnostics. Unacknowledged diagnostics will be flashing.
3	Press the Up Arrow or Down Arrow button and a cursor will appear on the display. Use the Up Arrow or Down Arrow button to position the cursor on a flashing diagnostic and press Enter to acknowledge the diagnostic. The flashing will stop and the cursor will disappear. If you do not press any button for a period of 5 seconds, the cursor will disappear. This is a safety feature, because while the cursor is visible on the display, the display is temporarily disabled and a new diagnostic will not be shown.
4	If there are more flashing diagnostics, press the Up Arrow and Down Arrow buttons to restore the cursor.

Display All Analogs

Displays current value of all analog points in the instrument. These include all analog I/O, loops, calculated values, totalizers and system parameters. Only those points that have been programmed will be displayed.

Display All Discretes

Displays current status of all discrete points in the instrument. These include all discrete I/O, alarms, loops, calculated values, totalizers and system parameters. Only those points that have been programmed will be displayed.

Delete All Diagnostics

A diagnostic is not automatically cleared from the summary when the error has been found and corrected. Table 7-8 gives the procedure for deleting the diagnostics.

Table 7-8 Delete All Diagnostics Procedure

Step	Action
1	Select ACCESS SUMMARIES from the Main On-Line Menu.
2	Select DELETE ALL DIAGNOSTICS and press Enter to delete all diagnostics from the summary.
3	Press Menu or Display buttons to exit the menu.

Product Information

Select this item to display the logo screen, which includes the product identification, software version number, part number of the PROM, and serial number.

7.4 Data Entry

Data Entry lets you enter or revise data online. Choices available depend on installed options and enabled features (see “Enable Features” in Section 4.19).

Edit Alarm Setpoints

Select this item to display a list of alarms and their setpoints. If the setpoint is a numeric value, it can be changed on this display using the Up Arrow, Down Arrow and Left Arrow buttons. If it is programmed as a parameter, it cannot be changed here.

Edit Constants

Select this item to display or change a list of all constants in the instrument. To change a value, use the Up Arrow, Down Arrow and Left Arrow buttons.

Force Discrete Inputs/Outputs

Select either of these items to display or force the status of any discrete.

The STATE indicates ON or OFF. FORCE/RELEASE indicates if the discrete is forced or released (unforced). To force a discrete, select FORCE ON or FORCE OFF. To release a forced discrete, select RELEASE. Adjust with Up Arrow and Down Arrow. Press Enter to enter the changes. Press Menu to leave the menu.

Adjust Analog Inputs

If the AI point has been configured with a pyrometer range, the Input Adjust is applied as a multiplier (equal to the newly entered value divided by the actual measured valued at the time that the adjustment is entered). In this case, the Value Adjust is referred to as an “emissivity” adjustment. If the AI point has been configured with any other range, the value adjust is applied as a bias (equal to the newly entered value minus the actual measured value at the time that the adjustment is entered).

All points on the display which are currently adjusted will have a Value Adjust Indicator (*) beside the value.

To adjust a value, select the desired AI and press Enter. Press Enter to highlight the value then use the Up Arrow, Down Arrow and Enter buttons to change the value on the display. The value can be changed to any value within the programmed limits of the AI.

To remove the value adjustment, set the value to OFF. The AI will display its current value and the indicator (*) will be removed.

Set Analog Outputs

This menu item will appear if the optional analog outputs are installed. It lets you adjust various analog output parameters.

Two output types are available: current output (CAT) and time proportion/duration adjusting (DAT).

Failsafe Value

Enter a value of 0 to 100% or an analog parameter for the initial output. This is the initial output on “cold start”. If the failsafe value is set to off, the output will go to 0.

Impulse Time

For DAT outputs, use the Up Arrow, Down Arrow and Enter buttons to adjust the impulse time. Impulse time must be ≥ 1 second. Impulse time is the cycle time for on and off cycling of the output. For example, an impulse time of 150 seconds will cause the output to be on for 75 seconds and off for 75 seconds when the input source is at 50.

- Reset totalizers

Select this item to display a list of all resettable Totalizers and their current values. If the Totalizer is non-resettable it will not appear. You may use this display to reset one Totalizer, or all at once. Note that some or all Totalizers may be configured to be non-resettable. Use the Up Arrow, Down Arrow and Enter buttons to select an item from the list. At the prompt “RESET”, press Enter to reset the Totalizer.

To reset all Totalizers, select the menu line “RESET ALL TOTALIZERS” and press Enter at the prompt. All resettable Totalizers will be reset.

7.5 Setpoint Profiles

For instructions on this menu, see Section 5.4 How to set up a profiler, Tables 5-4 and 5-5.

For instructions on common operator tasks with the Setpoint Profiler, see Section 5.5.

7.6 Tune Loop

This option lets you tune (change) various loop parameters online. These tunable parameters depend on the loop type in use and are described in Section 4.8, Program Control Loops. Also, the following menu choices are available.

Table 7-9 Tune Loop Prompts

Prompt	Range/Selections	Definition
LOOP TYPE	STD, ADV, SPLIT, ON OFF, CAS P, CAS S, RATIO, DIAT	STD: Standard ADV: Advanced SPLIT: Split Output ON OFF: On/Off CAS P: Cascade Primary CAS S: Cascade Secondary RATIO: Ratio DIAT: DIAT
PV	Number	Value of PV
OUTPUT	-100 to +100	Loop output %.
SETPOINT SOURCE	SP1 or SP2	Indicates which setpoint is being used by the loop. SP1 must be a number; SP2 may be a number or a value from a function block (remote setpoint).
Bold items are read-only		
TOGGLE SETPOINT SOURCE	SP1, SP2	Press Enter to change the Setpoint Source from SP1 to SP2 or vice versa.
SETPOINT #1	Number	Enter the new value of SP1.
SETPOINT #2	Number or parameter	Enter the new value of SP2. If SP2 is a remote setpoint you cannot change the value here.
PROP. BAND #1		See Gain #1.
GAIN #1	Enter a value of 0.1 to 200 for Gain, or 0.5 to 1000.0 for Proportional Band. Enter OFF to allow integral only control. (Variable Gain1 or PB1 is available by programming a constant's Destination with GN or PB. See Program Constants, Section 4.16.)	Gain is the proportional gain entry for the control loop (The value entered here is the gain applied to the error signal to determine the loop output. For example, a 10% change in process variable (with respect to the input range) from a balanced condition will result in a 10% change in output, when a gain of 1.0 is used. Enter a starting value at initial configuration. The value may be altered Online for final loop tuning. If an indirect source is specified as in an adaptive gain configuration, the value can only be altered at the source. Gain and Proportional Band are interchangeable values (Proportional Band = 100/Gain). For loops with dual tuning, Gain 1 is the gain for the first set of tuning parameters. Gain 2 is for the second set.

Table 7-9 Tune Loop Prompts (continued)

Prompt	Range/Selections	Definition
RESET #1	0.005-99.99 repeats/minute	Determines the period of time for a repeat of the proportional gain output. Enter a starting value at initial configuration. The value may be altered Online for final loop tuning. For loops with dual tuning, Reset 1 is the time for the first set of tuning parameters. Reset 2 is for the second set. (Variable Reset1 is available by programming a constant's Destination with RS. See Program Constants, Section 4.16.) A value of OFF may be entered to allow proportional-only control. When turned off, the manual reset value determines the loop output at setpoint. Bumpless manual to automatic transfer is canceled when proportional only control is selected.
RATE #1	0.02-10.00 minutes	Modifies the loop output based on the rate of change of the process variable. The output is modified by a value that assumes the rate of change of the process variable will continue for the time period specified. Enter a starting value or OFF at the time of configuration. The value may be altered Online for final loop tuning. For loops with dual tuning, Rate 1 is the rate for the first set of tuning parameters. Rate 2 is for the second set. (Variable Rate1 is available by programming a constant's Destination with RT. Program Constants, Section 4.16.)
PROP. BAND #2		See GAIN #1
RESET #2		See RESET #1
RATE #2		See RATE #1
MANUAL RESET	-100 to +100	This feature functions only when OFF is configured for the loop's RESET parameter. Enter a value equal to the desired loop output when the process variable is at setpoint. This allows correction of output to account for load changes to bring the process variable up to setpoint.
SUPPRESS OVERSHOOT	YES, NO	This parameter set to YES limits overshoot of the Setpoint (SP) by the Process Variable (PV) after a disturbance in the process such as a load or SP change. Through fuzzy logic, the working SP of the control loop is dynamically modified by the control algorithm to reduce or eliminate overshoot.
PRETUNE		Pretune calculates optimum values for a loop's Proportional Band/Gain, Reset and Rate by analyzing the reaction of the loop to a "step change" in setpoint or output. After these new tuning values have been calculated you have the option of applying (installing) or not applying them to a preselected tune set of the loop. You can pretune a loop while another loop is pretuning. See Pretune Loop on page 238.
SET TIMEBASE	5 MIN, 15 MIN, 30 MIN, 1 HR, 2 HR, 4 HR	Enter the timebase for the time axis of the tuning trend display.

Table 7-9 Tune Loop Prompts (continued)

Prompt	Range/Selections	Definition
DISPLAY TUNING TREND		Select this to display the actual tuning trend with PV and setpoint (Figure 7-2). Data collection for this trend display will continue as long as the display shows either the trend or the Loop Tuning Menu. Use this display to help find the optimal tuning parameters. Note: If you access this display through a loop display (by Tabbing to and selecting the loop tag name at the top of any loop display), the trend data is not buffered when you leave and return to this tuning trend display. Therefore, if you wish to adjust tuning parameters and then look at the trend to see the effects, it is recommended you select Tune Loop through the Online menu, not through a loop display.

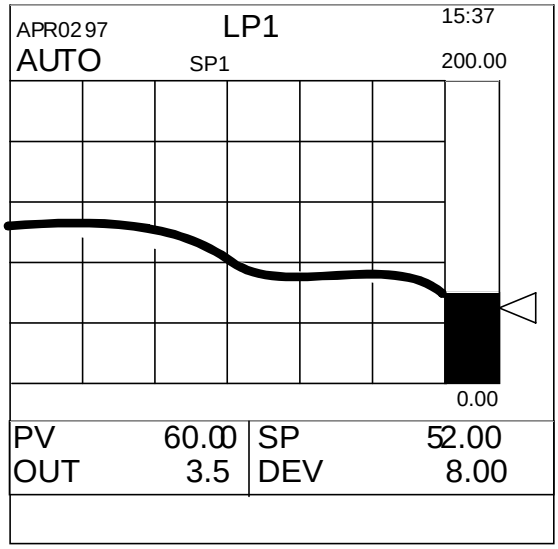


Figure 7-2 Control Loop Tuning Display

Pretune Loop

Pretune calculates optimum values for a loop's Proportional Band/Gain, Reset and Rate by analyzing the reaction of the loop to a "step change" in setpoint or output. After these new tuning values have been calculated you have the option of applying (installing) or not applying them to a preselected tune set of the loop. You can pretune a loop while another loop is pretuning.

To use pretune, your process time constant must be at least 60 seconds. The *process time constant* is defined as the time needed for the PV to change by 63% of a step change in the setpoint. For example, if the setpoint changes instantaneously by 100 degrees, the time constant is the amount of time needed for the PV to change 63 degrees.

To pretune a loop, select PRETUNE from the TUNE LOOP online menu. Select a loop to tune. Pretune occurs in 4 stages as indicated by the status. Each status has its own menu. Table 7-10 shows the stages of pretune.

Table 7-10 Stages Of Pretune

Order	Status	Meaning
1	STOPPED	Pretuning not operating, waiting to be started by operator. See STOPPED menu.
2	IDENTIFYING	Pretune is identifying process dynamics as a result of a setpoint or output change. This process may take up to 4 to 6 process time constants. See Table 7-12
3	CALCULATING	Identification is complete and calculation of new tuning parameters is in process. See Table 7-12
4	COMPLETE	Calculations are complete and new parameters are ready to replace the loop's tuning parameters, if desired. See Table 7-13

NOTE: While using Pretune, it is recommended that Overshoot Suppression is turned off. With overshoot suppression on, Pretune may not work or may give inaccurate tunings.

Pretune STOPPED menu

Table 7-11 describes the Pretune STOPPED prompts.

Table 7-11 Pretune STOPPED Prompts

Prompt	Range/Selections	Definition
STATUS	This is a read-only prompt.	Status stopped.
PV	This is a read-only prompt.	Current process variable value of the loop being tuned.
OUTPUT	This is a read-only prompt.	Current output value of the loop being tuned.
SETPOINT	This is a read-only prompt.	Current working set point value of the loop being tuned
TUNE SET	Select which set of tuning parameters (#1 or #2) will be pretuned and installed.	If tuning a split loop, set#1 applies to loop output between 0 and +100; set#2 applies to loop output between 0 and -100.
OPTIMIZE	Select SET PT or LOAD	This optimizes the new tuning parameters according to their intended use (that is, controlling changes in setpoint or process load).
OVERSHOOT	Select YES or NO.	This determines whether or not some overshoot is acceptable in the pretune specified tuning.

Continued on next page

Table 7-11 Pretune STOPPED Prompts (continued)

Prompt	Range/Selections	Definition
OUTPUT SIZE	-100 to +100	Appears if loop is in Manual. Enter the largest change in output (+ or -), in engineering units, that the process will tolerate. The pretune will initiate and analyze this output change.
SP STEP SIZE	-100 to +100	Appears if loop is in Auto. Enter the largest change in setpoint (+ or -), in engineering units, that the process will tolerate. The pretune will initiate and analyze this setpoint change.
START		Select to start the pretune function. See **Before Starting Pretune** below.

Before Starting Pretune

Before starting Pretune, configure/adjust the loop as follows:

Auto/Manual: Either mode is acceptable. Changing the loop mode after starting pretune will abort the pretune, causing an error message to appear.

Process Variable: Adjust setpoint or output to bring the process variable to normal operation range. Adjusting or switching setpoints or output after starting pretune will abort the pretune, causing an error message to appear.

Gain/Proportional Band, Reset: Use known good settings. Or, set Gain = 1.0 (PB = 100), Reset = 1.0 and place loop in Manual mode.

Rate: Optional. If OFF, pretune will not calculate a Rate.

Suppress Overshoot: Set to OFF. Pretune may detect changes to the working setpoint and abort. Turn this setting back on after pretune is complete.

After Starting Pretune

After starting the pretune, do not change/adjust the loop mode, loop output, loop setpoint, or operating mode. If you do, the pretune will abort. See Pretune Abort Messages later in this section.

Pretune IDENTIFYING & CALCULATING menus

During IDENTIFYING and CALCULATING status, a TUNE indicator appears on all primary displays (not on menus) for the loop being pretuned.

Table 7-12 Pretune IDENTIFYING & CALCULATING Prompts

Prompt	Definition
STATUS	Status Identifying or Calculating. This is a read-only prompt.
PV	Current process variable value of the loop being tuned. This is a read-only prompt.
OUTPUT	Current output value of the loop being tuned. This is a read-only prompt.

Table 7-12 Pretune IDENTIFYING & CALCULATING Prompts
(continued)

Prompt	Definition
SETPOINT	Current working set point value of the loop being tuned. This is a read-only prompt.
RUN TIME	Elapsed time since pretune was started. This is a read-only prompt.
ABORT	Select to cancel identifying and calculating and return to the stopped status.

Pretune COMPLETE menu

Table 7-13 describes the Pretune COMPLETE prompts.

Table 7-13 Pretune COMPLETE Prompts

Prompt	Definition
STATUS	Status Completed. This is a read-only prompt.
PB/GAIN	New Prop. Band or gain determined by pretune. This is a read-only prompt.
RESET	New Reset determined by pretune. This is a read-only prompt.
RATE	New Rate determined by pretune. This is a read-only prompt.
INSTALL	Select to install the new pretune values into loop's tuning parameters (specified by TUNE SET in Table 7-11.)
ABORT	Select to delete the new pretune values if you do not wish to install them.

Pretune Abort messages

One of the following messages is displayed when an unusual event has aborted the pretune. "PTA" means "Pretune Abort."

Table 7-14 Pretune Abort Messages

Message	Meaning/User action required
PTA-WARM START	A warm start occurred during pretune. Repeat pretune.
PTA-WENT OFFLINE	Instrument went out of Online mode during pretune. Repeat pretune.
PTA-LOOP STATUS	Loop has PV that is bad (i.e. failed sensor) OR PV is a constant value such as from an upstream block in manual OR Loop has back calculation value from a downstream block that is bad or is the result of the downstream block being in manual. Repeat pretune.
PTA-AM SEL CHNGE	Loop switched between automatic and manual modes. Repeat pretune.
PTA-SP SEL CHNGE	Loop was in automatic mode and an attempt was made to switch between Setpoint #1 and Setpoint #2. Repeat pretune.
PTA-OUT MOVED	Loop was in manual mode and loop's output value changed. Repeat pretune.
PTA-SP MOVED	Loop was in automatic mode and the setpoint value changed. Repeat pretune.
PTA-LOOP OS	Loop is out of service. Fix loop before repeating pretune.
PTA-LOOP NOT CFG	Loop is not configured. Configure loop before repeating pretune.
PTA-BAD STEP SIZ	Step size is turned off. Set step size to a value before repeating pretune. See Table 7-11.
PTA-ONOFF LOOP	Cannot pretune an on/off type loop.
PTA-BAD SN RATIO	Increase step size. See Table 7-11.
PTA-BAD OSC	Repeat pretune with smaller gain or proportional band in loop.
PTA-BAD ID VALUE	Increase step size. See Table 7-11.
PTA-DB ACCESS	Unknown hardware problem. Consult service.
PTA-TASK FAIL	Unknown hardware problem. Consult service.

7.7 Set Mode

Select this item to change the operating mode of the instrument to Program or Maintenance. These operating modes are discussed in Sections 4, 5, and 8.

7.8 Review Programming

This item is visible only if enabled under Enable Features in the Program mode.

Select this item to see how the instrument is configured. You can view all Program mode menus as if you were in Program mode, but you cannot change anything.

8. Maintenance

8.1 Overview

This section includes information on maintenance through the Maintenance Mode menu using some off-line utility programs and diagnostics procedures.

To avoid voiding the warranty, contact your service provider before attempting any service or repair of this instrument.

Maintenance Mode is an off-line mode for maintaining proper operation of the instrument and setting defaults.

Enter Maintenance Mode by selecting "MAINTENANCE" on the "SET MODE" line of the On Line or Program Main Menu. Remember that this mode is an off-line mode.

Table 8-1 Maintenance Mode Menu

Menu as displayed	Function
SET MODE	Changes operating mode of instrument
CALIBRATE ANALOG INPUTS	Calibrates Analog Inputs
CALIBRATE ANALOG OUTPUTS	Calibrates Analog Outputs
OFF-LINE DIAGNOSTICS	Runs diagnostic tests to check various instrument functions
DATABASE SERVICES	Clears instrument memory. Upgrades software features
RESET UNIT	Resets instrument to recognize changes to Main Frequency or Scan Frequency
PRODUCT INFORMATION	Displays product information
MAINS FREQUENCY	Sets the power supply frequency (50 or 60 Hz)
WARM START TIME	Sets warm start time
DEMO	Enables simulated input values. For demonstration purposes only

What's in this section

The following topics are explained in this section.

8.2 Routine Maintenance

CAUTION

Calibrate the instrument routinely to ensure conformity to specifications. Calibration is to be performed by qualified service personnel only.

Clean the front panel with a damp cloth. If needed, use a detergent containing no abrasives. Always clean the front panel with the bezel closed. **Do not use solvent cleaners.**

Failure to comply with these instructions may result in product damage.

8.3 Set Mode

Select this to change the operating mode to Online or Program.

NOTICE

Changing to ONLINE mode by pressing any of the Display buttons can cause incorrect values to be displayed. The values will correct themselves in a few seconds. To avoid this potential annoyance, change to online mode through SET MODE instead of through the Display buttons.

8.4 Calibrate Analog Inputs

Note: the unit must be allowed to warm up for 30 minutes at the intended operating temperature prior to calibration.

Selecting the CALIBRATE ANALOG INPUTS lists a number of calibration functions you can perform.

Selecting the CALIBRATE ANALOG INPUTS again allows you to specify the AI module and channel in which to calibrate. When you Select Input, you must apply a 0% reference (low point calibration) value to the terminal block of the module channel. Then select CALIBRATE to start the calibration routine. After calibration of 0% value is completed, apply a 100% range value to the channel input terminals and then begin the calibration routine for 100% input (high point calibration).

When 100% range value calibration is completed, the controller compares the new 0% and 100% range values against the current 0% and 100% values. If the span of the 0% and 100% readings is less than 20% of the sensor range, the new values are rejected and the current calibration is retained.

Each channel must be calibrated for the specific input type to be applied to that channel. Calibration values can be copied from one channel to all other channels of like input type and range.

NOTE: Signal generators should have an accuracy of at least 0.05 %. The type of wires depends on the sensor used. Wait for 5 minutes after that particular sensor is connected (for compensation wires only).

WARNING

In thermocouple pay attention to the ambient temperature. If you are using a mV generator instead of direct thermocouple generator, the leadwires are in copper and you have to subtract from the mV value the mV corresponding to the ambient temperature of the rear terminals. (This eliminates the effect of the cold junction compensation).

Failure to comply with these instructions could result in death or serious injury.

Additional calibration selections allow you to perform other calibration procedures:

CALIBRATE REFERENCE JUNCTIONS – for calibrating the two Cold Junction (CJ) references on AI module.

COPY ANALOG INPUT CALIBRATION – for copying calibration values from one AI module channel to another.

RESET ANALOG INPUT CALIBRATION – to restore AI module channels to their factory calibration.

RESET REF. FUNCTION CALIBRATION – to restore CJ reference to their factory calibration values.

8.5 AO MODULE calibration

Two calibration selections are accessible under the CALIBRATE AO menu selection

CALIBRATE AO CHANNEL – to calibrate the zero offset and span values of the AO module channels to user-defined values.

RESTORE AO FACTORY CAL – to restore factory calibrated to an AO module channel.

The AO module contains a wire jumper (labeled ST1) on the PWA. Cutting this jumper will prevent any changes to initial calibration values of the module and prevent any further field calibration.
See Figure 8-1 for the location of the jumper.

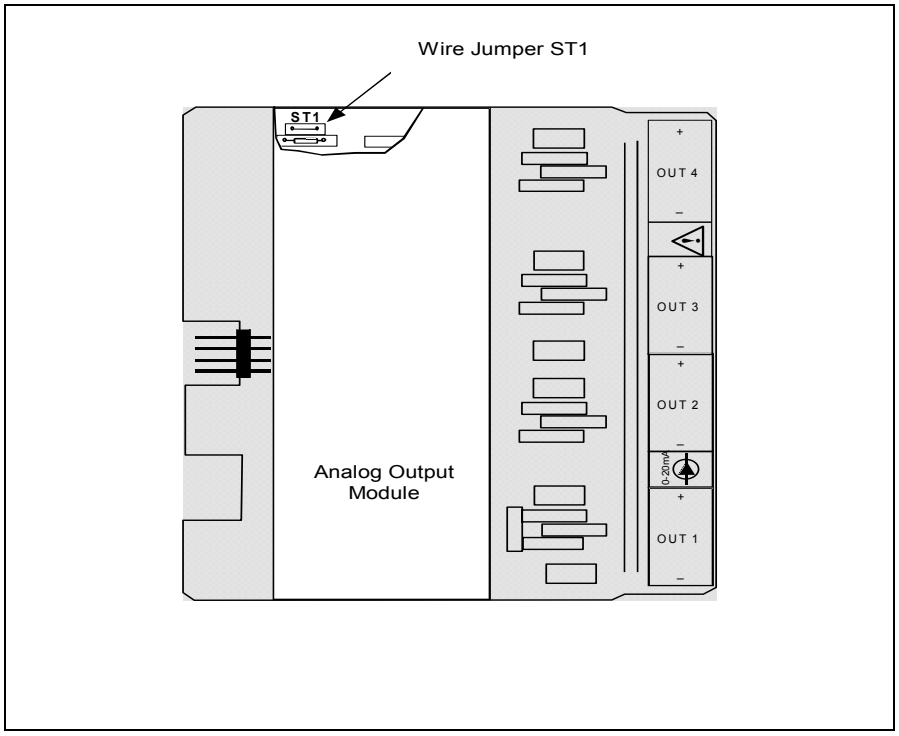


Figure 8-1 AO Module Jumper ST1

Calibrate Analog Outputs

For CAT calibration, a precision milliammeter or a precision resistor and voltmeter is required.

⚠ WARNING

Disconnect power to all terminals before connecting or disconnecting calibration leads. Hazardous voltage is present on the mains terminals and may be present on other terminals. More than one switch may be required to de-energize the unit before servicing.

Failure to comply with these instructions could result in death or serious injury.

NOTICE

Time-stamp and description of successful calibrations are stored to disk in the Event file.

Table 8-2 Calibrate Analog Output Procedure

Step	Action
1	Connect the meter to the output #1 terminals.
2	Select CALIBRATE ANALOG OUTPUTS.
3	Select OUTPUT #1 LOW. The menu will disappear and the meter will read approximately 4 mA (CAT).
4	Use the Increment and Decrement buttons to adjust the meter reading to the exact low value 4 mA. Press Enter when done.
5	Select OUTPUT #1 HIGH. The menu will disappear and the meter will read approximately 20 mA (CAT).
6	Use the Increment or Decrement buttons to adjust the meter reading to the exact high value. Press Enter when done.
7	Repeat steps 1-6 to calibrate other CAT outputs.
8	Press Menu to restore the main Maintenance menu.

8.6 Off-line Diagnostics

The following table describes the prompts.

Table 8-3 Offline Diagnostic Prompts

Prompt	Function
RAM SIZE (KB)	Shows amount of RAM found during power-up self-test. If less than 3072KB, replace the CPU.
KEYBOARD TEST	Select this to verify operation of each key. When each key is pressed, its name should appear onscreen. An AT keyboard can also be tested if connected.
DISPLAY TEST	Select this then press Enter to test each display color: red, green, blue, white, black. Any failed display pixels should be apparent.
DISK READ/WRITE TEST	Select this to verify read/write disk function.

8.7 Database Services

The following table describes the prompts.

Table 8-4 Database Services Prompts

Prompt	Function
CLEAR ALL MEMORY	Clears the Instrument memory of all programming, tuning data, setups, etc. and restores the original factory-set default values for all parameters, functions and analog output calibration. Does not affect analog input calibration.
FULL UPGRADE	Upgrades all function blocks of the instrument from a disk file with .LNF extension. Overwrites all function blocks. Executes Clear All Memory after this service.
INCREMENTAL UPGRADE	Upgrades the instrument with the desired options from a disk file with .LNI extension. Does not affect existing function blocks or configuration.
SOFTWARE UPGRADE	Upgrades product software from disk.

8.8 Reset Unit

Select this item to reboot the unit after making changes to Mains Frequency. This function clears all RAM buffers (storage and display) and accumulated values of some function blocks (Calculated Value timers, totalizers, and control loop integral) are reset to initial values.This function does **not** clear memory.

8.9 Product Information

Select this item to display the product identification, software version number, PROM part number, and serial number.

8.10 Mains Frequency

Select either 50 Hz or 60 Hz. Afterward you must select RESET UNIT to activate this change.

8.11 Warm Start Time

The instrument will start up in one of three modes based on the length of time power is off.

First Time Start

First time start occurs when the unit is being powered up for the first time or when the memory clear services maintenance routing is executed. All configuration and calibration is cleared and all parameters are set to factory defaults. See “DATABASE SERVICES” Section 8.7.

Cold Start

Cold start occurs when the unit is without power for a period longer than 90 minutes or if the reset unit maintenance routine is executed. See Section 8.8 Reset Unit. In cold start operation, all RAM buffers (storage and display) are cleared and accumulated values of some function blocks (Calculated Value timers, totalizers, and control loop integral) are reset to initial values. The cold start operation retains the loop operating status of auto or manual and setpoint 1 or setpoint 2. The loop output will be set to zero (0) unless configured to use a Failsafe value for the analog output.

No Data collected and stored to floppy disk before the onset of cold Start is lost.

Data storage is automatically resumed after a Cold Start; a maximum of 1 minute of buffered data will be lost due to a Cold Start. If a new disk was inserted into the floppy drive while power was off, you must initialize the new disk to resume data storage.

Warm Start

If power is off for less than 90 minutes, a warm start will be used during power-up. All buffered data prior to power loss is retained and accumulated values in Calculated Value timers and totalizers are retained. Control loop output values are also retained. Setpoint Profilers resume where they left off. If power is off for more than the warm up start time, a cold start operation will occur.

Warm start times available (in minutes): 1, 2, 3, 4, 5, 10, 15, 20, 30, 60, 90, None

Note that all data storage schedules that have been initialized or started via the ON LINE mode DATA STORAGE SETUP menu will automatically resume their execution upon the occurrence of a Warm Start.

8.12 Demo

This item is intended primarily for sales demonstrations. It causes the instrument to display a series of simulated values.

NOTICE

Never turn the demo on in an instrument that has already been configured to support its true application without first saving the instrument's configuration to floppy disk. Selecting DEMO will reconfigure Analog Inputs 1 through 4 and Discrete Input 1. When DEMO is turned off, the demo's function block configurations are still used but their inputs are tied to the hardware and are no longer simulated. It is recommended that the user clears memory after DEMO is turned off.

9. Diagnostic and error messages

9.1 Diagnostic Messages

The instrument executes diagnostic routines during instrument start-up and during maintenance procedures such as calibration. It also monitors online operation for both process faults and instrument errors.

Error messages

Table 9-1shows messages that may appear on the instrument displays if a diagnostic condition is detected, along with the action you should take.

Table 9-1 Diagnostic Error Messages

Message	Description	User action
INPUT FAILURE	The analog input is either open/shorted	Check input devices for open or short.
	The analog input has been exposed to electromagnetic noise.	See Section 2 for proper wiring techniques.
	The analog input is out of range	Choose a higher range.
FLOAT PT ERROR	A floating point calculation error has occurred. (divide by zero, underflow, overflow).	Check Free Form Math and Math CV inputs for division by 0. Also check for input values producing an underflow or overflow error (that is, calculation is not between $-1x10^{-38}$ and $-3x10^{38}$ or is not between $1x10^{-38}$ and $3x10^{38}$).
CHECKSUM ERROR	An error was detected in the database of one or more function blocks. The affected function blocks are reset to their defaults.	Inspect entire instrument configuration and reconfigure as needed.

ATTENTION

Be advised that the **INPUT FAILURE** diagnostic will continue to be displayed even after its cause has disappeared. After verifying that this diagnostic's cause has been corrected, you may clear the **INPUT FAILURE** message from all **ON LINE** screens by performing one of the following sequences of steps.

1) Acknowledge the INPUT FAILURE diagnostic.

From the **ON LINE** main menu, select **ACCESS SUMMARIES**. Select **DISPLAY DIAGNOSTICS**. Use the **<Up>** and **<Down>** buttons to highlight the **INPUT FAILURE** diagnostic(s) that you wish to acknowledge and then press **<Enter>**. Once the diagnostic has been acknowledged, it will still be listed in the **DISPLAY DIAGNOSTICS** screen but will no longer be displayed on any **ON LINE** screen.

2) Delete the INPUT FAILURE diagnostic.

From the ON LINE main menu, select ACCESS SUMMARIES. Select DELETE ALL DIAGNOSTICS. Once this menu choice has been executed, all diagnostic messages will be deleted from the DISPLAY DIAGNOSTICS screen and will no longer be displayed on any ON LINE screen.

During power-up, if an analog input is open or is out of range, the setpoint and process variable values will display OFF and the loop's AUTO mode is disabled. Check connections to determine problem. During calibration if the input reference voltages supplied by the technician are outside acceptable limits a "CALIB FAIL" message will be generated.

Internal error messages

In addition to diagnostic messages, error messages are presented to indicate an internal fault. To correct the problem, Table 9-2 lists suggested actions you should take, in the order you should take them. To acknowledge or clear the error message, see Section 7.2 Access Summaries.

Table 9-2 Internal Error Messages

Error message	Suggested Action
NONV RAM ERROR	1. Reduce the configuration by eliminating function. 2. Call service provider.
PROCESSOR EXCEPTION	1. Reset unit. 2. Clear configuration and reload. 3. If message recurs, replace CPU.
PROCESSOR RESET	1. Reset unit. 2. Clear configuration and reload. 3. If message recurs, replace CPU.
TASK INIT FAILURE	1. Reset unit. 2. Clear configuration and reload. 3. If message recurs, replace CPU.
QUEUE READ FAILURE	1. Reset unit. 2. Clear configuration and reload. 3. If message recurs, replace CPU.
RESPONSE FAILURE	1. Reset unit. 2. Clear configuration and reload. 3. If message recurs, replace CPU.
REQUEST FAILURE	1. Reset unit. 2. Increase scan rate to higher time; for example, from 500 msec to 1 second. 3. Clear configuration and reload it. 4. If message recurs, replace the CPU.
AED REPORT FAILURE	1. Reset unit. 2. Increase scan rate to higher time; for example, from 500 msec to 1 second. 3. Clear configuration and reload it. 4. If message recurs, replace the CPU.
AED HANDSHAKE FAILURE	1. Reset unit. 2. Increase scan rate to higher time; for example, from 500 msec to 1 second. 3. Clear configuration and reload it. 4. If message recurs, replace the CPU.
FB TASK OVERRUN	Increase scan rate to higher time; for example, from 500 msec to 1 second.
AI TASK OVERRUN	1. Check for noise. 2. Increase scan rate to higher time; for example, from 500 msec to 1 second.

continued

Table 9-2 Internal Error Messages (continued)

Error message	Suggested Action
SLOT CARD FAILURE	1. Check for noise. 2. Check AI card connection. 3. Replace AI card.
STORAGE FAILURE	1. Check for bad floppy disk. 2. Run disk diagnostic on the disk drive. 3. Check seating of floppy cables. 4. Replace CPU.
DATA STORAGE STATUS LOST	1. Check for bad floppy disk. 2. Run disk diagnostic on the disk drive. 3. Check seating of floppy cables. 4. Replace CPU.
RJ FAILURE	1. Check reference junction sensor connection. 2. Check AI card. 3. Replace CPU.
CLOCK FAILURE	1. Reprogram clock. 2. Reset unit. 3. Change lithium battery on interconnection board. 4. Replace CPU.
CLOCK RESET	1. Reprogram clock. 2. Reset unit. 3. Change lithium battery on interconnection board. 4. Replace CPU.
TIMING ERROR	1. Reprogram clock. 2. Reset unit. 3. Change lithium battery on interconnection board. 4. Replace CPU.
TASK ERROR	1. Reset unit. 2. Clear configuration and reload. 3. If message recurs, replace CPU.
RAM ERROR	1. Run RAM diagnostic. 2. Replace CPU.
COMM PORT ERROR	1. Check communications card seating. 2. Replace communications card. 3. Replace CPU.

9.2 Loop Error Indicators

When a loop's PV, SP2, or other parameter fails, the loop switches to its default/failsafe condition, indicated by certain display symbols flashing. To return the loop to its desired condition, correct the failure. Then, if the loop's LATCHING is NO, the loop will return to normal automatically. If LATCHING is YES, also perform the action needed to return the loop to normal.

Table 9-3 Abnormal Loop Conditions And Indicators

Desired Condition	Abnormal Condition	Default condition (Failsafe)	Flashing symbols	Action needed (if LATCHING = YES)
Auto & SP2	SP2 Failure	Working SP=SP1	SP2	Select SP1 then SP2
Manual & SP2	SP2 Failure	Working SP=SP1	SP2	Select SP1 then SP2
Auto & SP2	SP2 & PV Failure	Working SP=SP1 Mode = Suspend Auto* Output = Failsafe	SP2 AUTO MAN** PV	Select SP1 then SP2 Select Manual then Auto
Manual & SP2	SP2 & PV Failure	Working SP = SP1 Mode = Manual Output = Last value	SP2 PV	Select SP1 then SP2
Auto & SP1/SP2	PV Failure **or** Force Remote Manual Failure **or** Output Tracking Failure **or** Feedforward Failure	Mode = Suspend Auto* Output = Failsafe	AUTO MAN** PV	Select Manual then Auto
Manual & SP1/SP2	PV Failure	Mode = Manual Output = Last Value	PV	None required
Auto & SP1/SP2	See below***	Mode = Suspend Auto* Output = Back Calc. Value	AUTO MAN	None required
Auto & SP1/SP2	Force Remote Manual	Mode = Suspend Auto* Output = Tracking value	AUTO	None required

*Due to the abnormal condition the loop cannot be in Auto and therefore is in a temporary mode which forces the output as indicated.

**If loop feedback is not connected to an AO, or if loop type is ON/OFF, then MAN will be steady, not flashing.

***Status from a downstream function block indicates that there is no path to final output element. For example, the secondary control loop of cascade configuration was changed to manual mode.

9.3 Error Messages

Overview

Sometimes errors occur while you are programming or loading a configuration into your instrument. In most cases the instrument displays a descriptive error message. For example, if you try to program a function block incorrectly, the instrument tells you the problem.

Table 9-4 lists these error messages along with a description of each one and what action to take.

Table 9-4 Error Messages

Error	Description	User Action
Alarm/Event/Diagnostic burst and transitions lost	The instrument had an Alarm/Event/Diagnostic burst in the controller and some transitions were lost.	Inspect the Alarm Summary/History and the Discrete Summary Screen to resolve any missing or unresolved alarms vs their current states. If the state transition that was missing was an off state it will be matched and processed upon the next on-off transition of the corresponding alarm.
Block Phase Greater Than Block Period	In Periodic Timer CV, the phase (start time) is greater than the period. For example, the start time is 8:00 and the period is 4:00.	Change Period to greater than phase (Start Time) or change Start Time to less than Period.
Channel Does Not Exist	A channel was loaded that does not exist. For example, you loaded a dual loop configuration into a single loop instrument.	Verify programming of affected function block.
Circuit Limits Equal	Indirect circuit low/circuit high limits must be unequal.	Change to unequal limits.
Condition Type Out of Range	Condition Type (Compare, Logic, Free form Logic) is out of range. Probably caused by someone incorrectly editing the configuration file or by a corrupt .LNC file.	Verify programming of affected function block.
Desired F0 Value Not Programmed or Less Than Zero	In the F_0 Sterilization CV, desired F_0 is not programmed or is less than zero.	Change F_0 value to greater than zero.
High Limit Outside of circuit	AI circuit high limit is > voltage limit of 5200 mV.	Change limit to within specified limits for that type.
High Output Limit Greater than 20	A current output (CAT) high output limit cannot be greater than 20	Decrease high limit.
Hysteresis Less Than Zero	Alarm Hysteresis parameter should be greater than or equal to zero.	Increase Hysteresis.
Impulse Time less than or Equal to 0	Impulse time on a time proportioning/duration adjusting output (DAT) cannot be less than or equal to zero.	Increase impulse time.
Incompatible Curve Type	AI is custom type, thermocouple class, reference junction enabled but Y values are not always increasing or not always decreasing.	Reprogram curve so that for all n: $Y_n > Y_{n+1}$ or $Y_n < Y_{n+1}$

Table 9-4 Error Messages (continued)

Error	Description	User Action
Incorrect Input coordinates	The Advanced Splitter CV was programmed with input limits for Output#2 (A2) only, or for Output#1 & #3 (A1 & A3) only, or for Output#3 (A3) only.	Re-program input limits for Output#1 only, Outputs #1 & #2, or Outputs #1, #2, & #3.
Incorrect Number of Parameters for function	The function was not programmed with the minimum number of parameters. for example, the Math CV requires at least 2 inputs to function properly.	Program function with at least the minimum number of parameters.
Incorrect Output Coordinates	The Advanced Splitter CV was programmed with output limits for Output#2 (A2) only, or for Output#1 & #3 (A1 & A3) only, or for Output#3 (A3) only.	Re-program output limits for Output#1 only, Outputs #1 & #2, or Outputs #1, #2, & #3.
Invalid Algorithm Code	Bad algorithm code has been given, bad algorithm choice. Probably caused by someone incorrectly editing the configuration file or by a corrupt .LNC file.	Verify programming of affected function block.
Invalid Block Number	Probably caused by someone incorrectly editing the configuration file or by a corrupt .LNC file.	Verify programming of affected function block.
Invalid Block Type	Probably caused by someone incorrectly editing the configuration file or by a corrupt .LNC file.	Verify programming of affected function block.
Invalid Channel in Point spec	Invalid channel has been found.	Verify programming of affected function block.
Invalid Equation	Free form math equation is invalid.	Check equation.
Invalid Function Block Request	Probably caused by someone incorrectly editing the configuration file or by a corrupt .LNC file.	Verify programming of affected function block.
Invalid Index code	Probably caused by someone incorrectly editing the configuration file or by a corrupt .LNC file.	Verify programming of affected function block.
Invalid Input Connection	Function block is programmed with wrong input type. Probably caused by someone incorrectly editing the configuration file or by a corrupt .LNC file.	Verify programming of affected function block.
Invalid Machine Update Rate	Bad machine scan rate.	Re-enter machine scan rate.
Invalid Parameter Code	Bad parameter code has been found. Generally caused by transferring configurations between instruments with different software versions.	Verify programming of affected function block.
Invalid Parameter for Data Type	Probably caused by someone incorrectly editing the configuration file or by a corrupt .LNC file.	Verify programming of affected function block.
Invalid Tag	Probably caused by someone incorrectly editing the configuration file or by a corrupt .LNC file.	Verify programming of affected function block.
Invalid Tag Request	Probably caused by someone incorrectly editing the configuration file or by a corrupt .LNC file.	Verify programming of affected function block.
Invalid Type in Point Spec	A class of block was detected that is invalid for the product.	Verify programming of affected function block.
Lag or Delay Less than Zero	AI lag or delay is less than zero.	Change lag or delay to greater than or equal to zero.

Table 9-4 Error Messages (continued)

Error	Description	User Action
Low Limit Outside of Circuit	AI circuit low limit is < voltage limit of -500 mV.	Change circuit low limit to > -500 mV.
Low limit Outside of Table	For thermocouple or RTD, Range Low limit is < the low limit for that type.	Change limit to within specified limits for that type. (Table 4-3)
Low Output Limit less than Zero	A current output (CAT) low limit is less than zero.	Change current output (CAT) low limit to greater than or equal to zero.
Monthly Periods Must Be Phased	Periodic Timer CV period is monthly but no phase is defined.	Change Periodic Timer phase.
No Room for Function Block	System has used all allocated function blocks.	Verify programming of affected function block.
Number of Frames Out of Range	Rolling Average CV # of Samples is less than 1 or greater than 60.	Change # of Samples to 1-60.
Out of EEPROM Memory	No more static memory or EEPROM memory.	Verify programming of affected function block.
Out of RAM Memory	No more RAM available.	Verify programming of affected function block.
Output Limits Equal	Output (range) limits (low and high) must be unequal.	Change to unequal limits
Pairs Inconsistent	Applies to custom AI or Function Generator CV. Curve has Xn but no Yn or vice versa. Curve does not have at least 2 X,Y pairs.	Program a Y for each X or vice versa. Program at least 2 X's and 2 Y's.
Request Made with Invalid Tag	Probably caused by someone incorrectly editing the configuration file or by a corrupt .LNC file.	Verify programming of affected function block.
Requires a Deviation Parameter	Deviation alarm does not contain deviation.	Program alarm with deviation.
Requires Input Parameter	Alarm does not contain an input.	Program alarm with input.
Requires Setpoint Parameter	Alarm does not contain a setpoint.	Program alarm with a setpoint.
RJ Not in Curve	AI is custom type, class thermocouple, RJ enabled but curve does not contain 0-65 degrees C (32-149 degrees F).	Y values must contain 0-65 degrees C (32-149 degrees F).
Temperature Constant Not Programmed or Less Than Zero	F0 Sterilization CV Temperature constant is not programmed or is less than zero.	Program Temperature constant with value greater than or equal to zero.
Temperature Input Not Programmed or Less Than Zero	F0 Sterilization CV Temperature Input is not programmed or is less than zero.	Program Temperature input with value greater than or equal to zero.
Temperature Reference Not Programmed or Less Than Zero	F0 Sterilization CV Reference Temperature is not programmed or is less than zero.	Program Reference Temperature with value greater than or equal to zero.

Table 9-4 Error Messages (continued)

Error	Description	User Action
Trend Has Too Many Points For Rate Selected	Data Storage cannot store more than 3 points at 1/4 second scan rate.	Change number of points to be compatible with scan rate.
Type Does Not Exist	A function block type was loaded that does not exist. For example, you loaded a Profile but the unit does not have the Profile option.	Re-program or re-load correctly.
Type Incompatible With Hardware	Analog output type is different from hardware setting. Attempted to assign 6th relay as a DAT function.	Change programming to be compatible with the hardware or vice versa, then reload configuration or reconfigure the block.
Type Requires Hardware	Hardware is missing for the programmed analog output or discrete output relay.	Either ignore the message knowing that those particular points did not get loaded or verify configuration and make sure that the points that are in the configuration match the hardware components.
Undefined Function Block Request	Internal Error.	No user action.
Value Written to Indirected Point	An input has been connected and user has tried to write a value to that input. For example, if a control loop setpoint is connected to AI1 OV, you will receive this message if you try to change the loop setpoint online.	Avoid changing connected values.
X Axis Must Increase	Appears if AI is custom type or CV is Function Generator and if Xn $\geq$ Xn+1.	Re-program Xn < Xn+1.
X Axis Not Increased Enough	Appears if AI is custom type or CV is Function Generator and if X does not increase by at least 0.00001.	Re-program X.
Y Axis Not Increased Enough	Appears if AI is custom type or CV is Function Generator and if Y does not change by at least 0.00001.	Re-program Y.

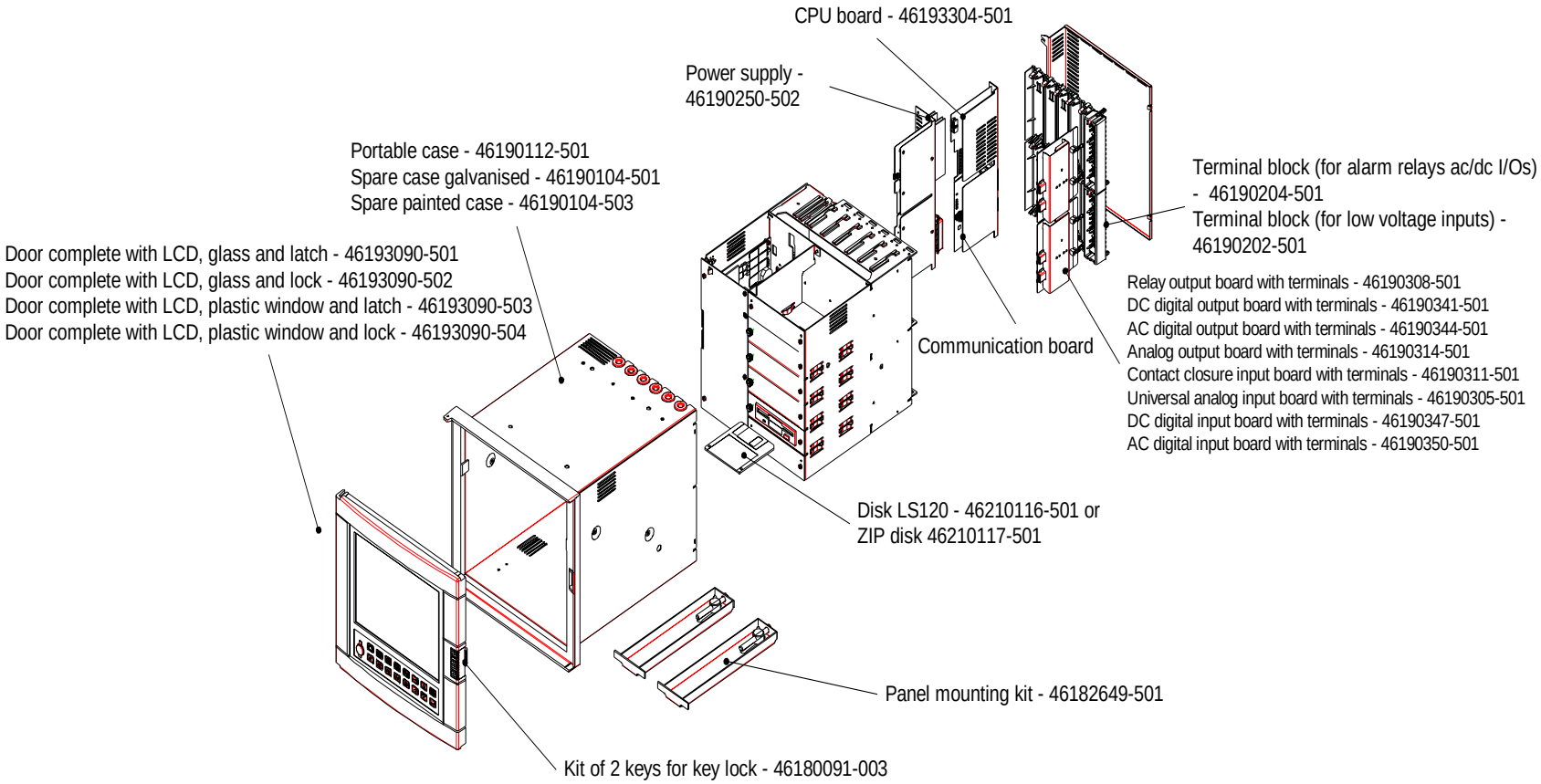
10. Parts

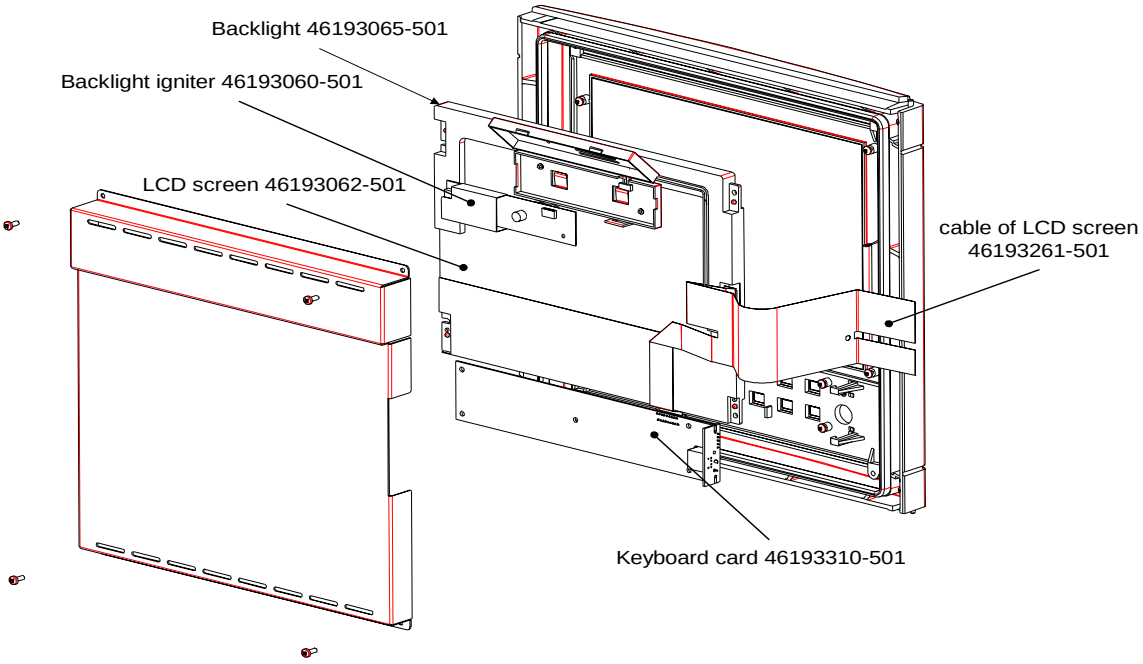
Table 10-1 Parts

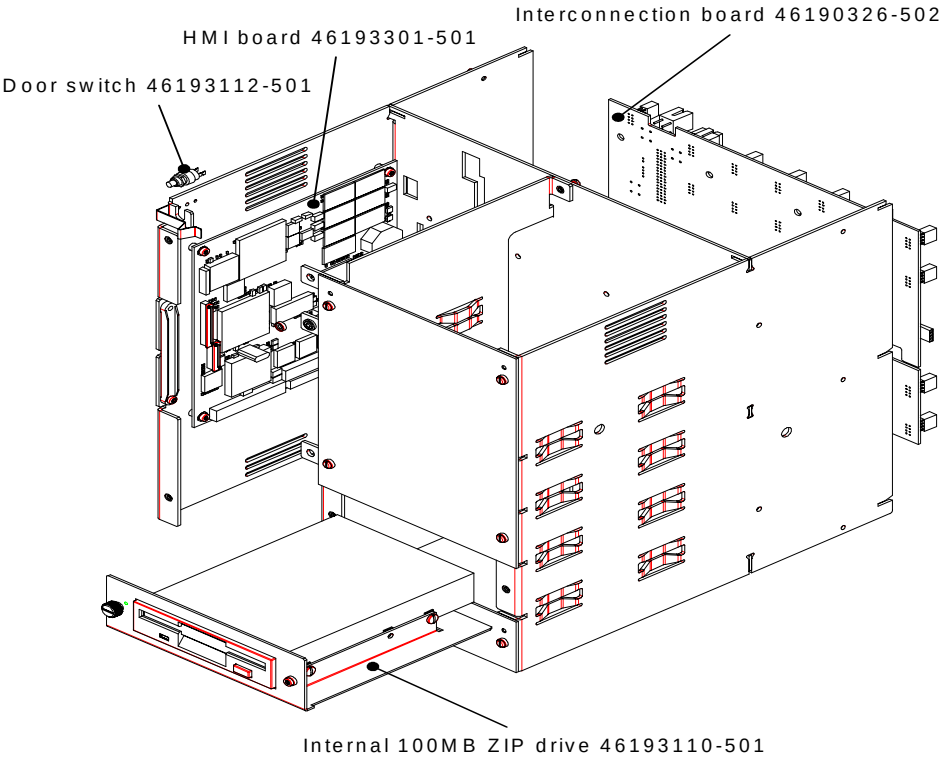
Kit Description	Kit Part Numbe	CK N
ELECTRONIC SOFTWARE		
Power supply	46190250-502	189
HMI board	46193301-501	241
CPU board	46193304-501	242
Interconnection board	46190326-502	243
Relay output board with terminals	46190308-501	192
DC digital output board with terminals	46190341-501	192
AC digital output board with terminals	46190344-501	192
Analog output board with terminals	46190314-501	222
Contact closure input board with terminals	46190311-501	192
Universal analog input board with terminals	46190305-501	192
DC digital input board with terminals	46190347-501	192
AC digital input board with terminals	46190350-501	192
Keyboard card	46193310-501	248
Backlight igniter	46193060-501	249
Communication board	46190260-502	214
Firmware upgrade - Communication	46193350-501	
MECHANICAL PARTS		
Door complete with LCD, glass window and latch	46193090-501	244
Door complete with LCD, glass window and lock	46193090-502	244
Door complete with LCD, plastic window and latch	46193090-503	244
Door complete with LCD, plastic window and lock	46193090-504	244
Portable case	46193121-501	252
Spare case galvanised	46193120-501	253
Spare painted case	46193120-503	253
Kit of 2 keys for key lock	46180091-003	
LCD screen	46193062-501	245

Kit Description	Kit Part Numbe	CK N
Backlight	46193065-501	246
Cable of LCD screen	46193261-501	247
Door switch	46193112-501	250

Kit Description	Kit Part Number	CK N°
MISCELLANEOUS		
Terminal block (for low voltage inputs)	46190202-501	201
Terminal block (for alarm relays, ac/dc I/Os)	46190204-501	201
Battery	46222201-502	204
Panel mounting kit	46182649-501	
Internal 100MB ZIP disk drive	46193110-501	256
CONSUMABLES		
Kit of 4 resistors 250 ohms	46181080-503	
Fuse	46182886-002	


CPU board - 46193304-501
Power supply - 46190250-502
Portable case - 46190112-501
Spare case galvanised - 46190104-501
Spare painted case - 46190104-503
Door complete with LCD, glass and latch - 46193090-501
Door complete with LCD, glass and lock - 46193090-502
Door complete with LCD, plastic window and latch - 46193090-503
Door complete with LCD, plastic window and lock - 46193090-504
Terminal block (for alarm relays ac/dc I/Os) - 46190204-501
Terminal block (for low voltage inputs) - 46190202-501
Relay output board with terminals - 46190308-501
DC digital output board with terminals - 46190341-501
AC digital output board with terminals - 46190344-501
Analog output board with terminals - 46190314-501
Contact closure input board with terminals - 46190311-501
Universal analog input board with terminals - 46190305-501
DC digital input board with terminals - 46190347-501
AC digital input board with terminals - 46190350-501
Communication board
Disk LS120 - 46210116-501 or ZIP disk 46210117-501
Panel mounting kit - 46182649-501
Kit of 2 keys for key lock - 46180091-003


Backlight 46193065-501
Backlight igniter 46193060-501
LCD screen 46193062-501
cable of LCD screen
46193261-501
Keyboard card 46193310-501


Interconnection board 46190326-502
HMI board 46193301-501
Door switch 46193112-501
Internal 100MB ZIP drive 46193110-501

Appendix A

A.1 Security Bypass Procedure

Overview

Your instrument has a security bypass code which allows you to enter secured areas of the product.. Use this bypass code if you have forgotten or lost the master and/or operator security code.

Bypass procedure

Table A-1 Security Bypass Procedure

Step	Action
1	When you are prompted for the master or operator security code, use the Increment and Decrement buttons to select the bypass code 783.
2	Press the Display button to display the forgotten master or operator code.
3	To return to the previous menu without entering the secured area, press the Menu button. To enter the secured area, press Enter.

ATTENTION

Remove this page for security.

SIKKERHESKRAV

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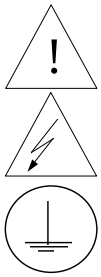

For at undgå elektrisk stød med mulighed for personskade, skal alle sikkerhedsbestemmelser i denne manual følges nøje.

Dette symbol advarer brugeren om en potentiel berøringsfare, såfremt der kan være adgang til den livsfarlige netspænding.

Beskyttende jordterminal. Terminalen er forberedt for og skal forbindes til beskyttelses-jordledning i henhold til stærkstrømsberkendtgørelsen (DK).

- Hvis udstyret ikke bruges som specificeret i manualen, kan den beskyttelse udstyret yder blive nedsat eller forsvinde.
- Eerstat kun komponenter som udtrykkeligt er specificeret som udskiftelige i manualen.
- Alle ledningsforbindelser skal følge stærkstrømsberkendtgørelsen (DK) og udføres af autoriseret erfarent personel.
- Den beskyttende jordterminal skal forbindes først af alle forbindelser (og fjernes som den sidste).
- Det anbefales jvf. stærkstrømsberkendtgørelsen, at der installeres en afbryder til frosyningsspændingen nær udstyret.

UDSTYRS SPECIFIKATIONER

Strømforsyning	100 til 240 V AC/DC
Frekvens	50 – 60 Hz
Nominel effekt	100 VA
Sikringsværdi	3.15 A / 250 V AC/DC

OMGIVELSES SPECIFIKATIONER

Placer ikke udstyret i nærheden af brandbare væsker eller dampe.

Temperatur	Rumtemperatur : 5 til 40°C
	Opbevaring : -20 til 60°C
Fugtighed	10 til 90% RH ikke kondenserende / 40°C
Vibration	10 til 40 Hz, amplitude 0.07 mm
	40 til 60 Hz, acceleration 0.2 g

UDSTYRS INSTALLATION

Skriveren skal monteres i en tavle for at forhindre adgang til bagterminaler.

VEILIGHEIDSVEREISTEN

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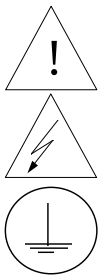


Ter vermindering van het gevaar van elektrische schokken die lichamelijk letsel kunnen veroorzaken, dient u alle veiligheidsaanwijzingen in dit dokument te volgen.

Dit symbool waarschuwt de gebruiker voor een potentieel schokgevaar wanneer toegang bestaat tot onderdelen die onder gevaarlijke spanning staan.

Beschermende aarde-aansluiting. Bestemd voor aansluiting van de aardingsdraad van de voeding.

- Indien de apparatuur wordt gebruikt anders dan door de fabrikant gespecificeerd, kan de bescherming, die de apparatuur biedt ongedaan worden gemaakt.
- Alleen die onderdelen mogen worden vervangen die door de fabrikant als uitwisselbaar zijn aangemerkt.
- Alle bedrading moet in overeenstemming zijn met de lokale elektriciteiseisen en moet aangelegd worden door geauthoriseerd, ervaren personeel.
- De aardingsdraad moet worden aangesloten vóórdat alle andere bedrading wordt aangesloten (en als laatste worden verbroken).
- Het verdient aanbeveling een netschakelaar aan te brengen vlakbij het instrument.

APPARATUUR VOORWAARDEN

Voedingsspanning	100 tot 240 V AC/DC
Frequentie	50 – 60 Hz
Vermogen of stroomvermogen	100 VA
Zekering	3.15 A / 250 V AC/DC

OMGEVINGSCONDITIES

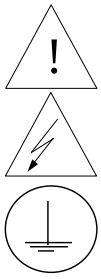
Gebruik het instrument niet in de aanwezigheid van ontvlambare vloeistoffen of dampen. Het gebruik van elk elektrisch instrument in een dergelijke omgeving vormt een gevaar voor uw veiligheid.

Temperatuur	In bedrijf : 5 tot 40°C
	Opslag : -20 tot 60°C
Vochtigheid	10 tot 90% RH niet condenserend / 40°C
Trilling	10 tot 40 Hz, amplitude 0.07 mm
	40 tot 60 Hz, versnelling 0.2 g

MONTAGE VAN DE APPARATUUR

De recorder moet worden gemonteerd in een paneel om de toegankelijkheid tot de achterste aansluitpunten te beperken.

TURVALLISUUSMÄÄRÄYKSET FI2I-6063



Noudata tämän ohjeen kaikkia turvaohjeita välttääksesi sähkötapaturman vaaraa.

Tämä merkki varoittaa käyttäjää sähköiskun vaarasta paikassa, missä voi koskettaa vaarallisia jännitteitä.

Suojamaaliitin. Kytke maadoitsjohdin tähän liittimeen.

- Jos laitetta käytetään olosuhteissa, joihin sitä ei ole suunniteltu, käyttöturvallisuus voi heikentyä.
- Älä vaihda mitään komponettia tai osaa, jota valmistaja ei ole määritellyt käyttäjän vaihdettavaksi.
- Asennus ja johdotus on tehtävä paikallisten varmuusmääräysten mukaisesti valtuutetun sähköasentajan toimesta.
- Ensimmäiseksi on kytkettävä suojamaa-liitin (ja viimeiseksi irroittettava).
- Laitteen läheisyyteen suositellaan asennettavaksi verkkokytkin.

LAITTEEN VAATIMUKSET

Syöttöjännite	100 – 240 V AC/DC
Taajuus	50 – 60 Hz
Teho	100 VA
Sulakearvo	3.15 A / 250 V AC/DC

KÄYTTÖOLOSUHTEET

Älä käytä laitetta paikassa jossa on syttyviä nesteitä tai kaasuja, koska laitteen käyttö aiheuttaa räjähdysvaaran.

Lämpötila	ympäröivä : 5 ... 40°C
	Varastossa : -20 ... 60°C
Kosteus	10 ... 90% RH non condensing / 40°C
Tärinä	10 ... 40 Hz, amplitude 0.07 mm
	40 ... 60 Hz, Kiihtyvyys 0.2 g

LAITTEEN ASENNUS

Piirturi on asennettava paneeliin siten, että peräliitimille jää riittävästi tilaa.

CONSIGNES DE SECURITE

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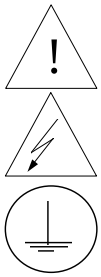


Pour réduire tout risque de décharge électrique qui pourrait provoquer une lésion corporelle, respectez toutes les consignes de sécurité de cette documentation.

Ce symbole avertit l'utilisateur d'un risque électrique potentiel lorsqu'il peut avoir accès à des éléments sous tension.

Borne de mise à la terre. Destinée au raccordement du conducteur de mise à la terre de l'alimentation.

- Si l'équipement est utilisé dans un but non spécifié par le constructeur, la protection fournie avec cet équipement peut être affectée.
- Aucun composant (ou pièce) ne doit être remplacé s'il n'est pas explicitement spécifié comme tel par le constructeur.
- Tous les câblages doivent être conformes aux normes locales et doivent être réalisés par un personnel autorisé et expérimenté.
- La borne de masse doit être raccordée avant tout autre câblage (et débranchée en dernier).
- Il est obligatoire de connecter cet appareil sur une ligne possédant un moyen de coupure près de l'appareil.

CARACTERISTIQUES DE L'EQUIPEMENT

Tension d'alimentation	100 à 240 Vca/cc
Fréquence	50 – 60 Hz
Puissance ou courant	100 VA
Fusible	3.15 A / 250 Vca/cc

CONDITIONS AMBIANTES

Ne jamais utiliser cet équipement en présence de liquides ou vapeurs inflammables.
L'utilisation de tout instrument électrique dans un tel environnement pourrait présenter un risque pour la sécurité.

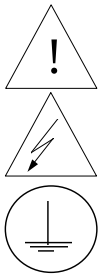
Température	Ambiante : 5 à 40°C
	Stockage : -20 à 60°C
Humidité	10 à 90 % HR non-condensé à 40°C
Vibration	10 à 40 Hz, amplitude 0,07 mm
	40 à 60 Hz, accélération 0,2 g

INSTALLATION DE L'EQUIPEMENT

Cet appareil doit être monté dans un panneau pour limiter l'accès aux bornes arrières par l'opérateur.

SICHERHEITSHINWEISE

GE2I-6063



Befolgen Sie alle Sicherheitshinweise in diesen Unterlagen, um das Risiko eines Stromschlags zu verringern, der zu Körperverletzung führen kann.

Dieses Symbol warnt den Benutzer vor eventueller Berührungsgefahr, wo lebensgefährliche Spannungen zugänglich sein können.

Schützende Erdung. Für den Anschluß der schützenden Erdung der Versorgungssystemleitung.

- Bei Benutzung der Ausrüstungen auf nicht vom Hersteller angegebene Art und Weise kann der von der Ausrüstung gewährleistete Schutz beeinträchtigt werden.
- Ersetzen Sie keine Komponente (oder Teil), die/das nicht ausdrücklich vom Lieferanten als ersetzbar angegeben ist.
- Die gesamte Verkabelung muß den örtlichen Normen entsprechen und von zugelassenem, erfahrenem Personal durchgeführt werden.
- Die Erde muß vor allen anderen Kabeln angeschlossen (und zuletzt abgeklemmt) werden.
- In der Nähe der Ausrüstung muß ein Schalter in der Hauptstromversorgung vorhanden sein.

AUSRÜSTUNGSDATEN

Netzspannung	100 bis 240 VAC
Frequenz	50 – 60 Hz
Nennleistung	100 VA
Sicherungswert	3.15 A / 250 VAC

UMGEBUNGSBEDINGUNGEN

Betreiben Sie das Gerät nicht in Gegenwart entflammbarer Flüssigkeiten oder Dämpfe. Der Betrieb elektrischer Geräte in solchen Umgebungen stellt ein Sicherheitsrisiko dar.

Temperatur	Umgebung : 5 bis 40°C
	Lager : -20 bis 60°C
Feuchtigkeit	10 bis 90% RH ohne Kondensation / 40°C
Vibration	10 bis 40 Hz, Amplitude 0,07 mm
	40 bis 60 Hz, Beschleunigung 0,2 g

ANBRINGUNG DER AUSRÜSTUNGEN

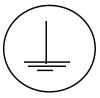
Der Regler muß in ein Pult eingebaut sein, damit der Bediener nicht zu oft auf die hinteren Anschlüsse zugreifen muß.

ΑΠΑΙΤΗΣΕΙΣ ΑΣΦΑΛΕΙΑΣ

ΓΡ2Ι–6063

Για την αποφυγή του κινδύνου ηλεκτροπληξίας που θα μπορούσε να προκαλέσει προσωπικό τραυματισμό, ακολουθείστε όλες τις υποδείξεις ασφαλείας αυτών των οδηγιών.

Το σύμβολο αυτό προειδοποιεί το χρήστη για πιθανό ηλεκτρικό κίνδυνο σε περίπτωση επαφής με επικίνδυνα μέρη της συσκευής.



Προστατευτικό τερματικό γείωσης. Παρέχεται για σύνδεση με τον αγωγό προστατευτικής γείωσης του συστήματος τροφοδοσίας.

- Εάν ο εξοπλισμός χρησιμοποιηθεί κατά τρόπο που δεν προβλέπεται από τον κατασκευαστή, διακινδυνεύεται η παρεχόμενη από τον εξοπλισμό προστασία.
- Μην αντικαταστήσετε κανένα μέρος (ή εξάρτημα) του οποίου η αντικατάσταση δεν προβλέπεται από τον κατασκευαστή.
- Όλες οι ηλεκτρικές εγκαταστάσεις πρέπει να είναι σύμφωνες με τα τοπικά πρότυπα και να πραγματοποιούνται από έμπειρους τεχνικούς.
- Το τερματικό εδάφους πρέπει να συνδέεται πριν από κάθε άλλη σύνδεση (και να αποσυνδέεται τελευταίο).
- Απαιτείται ένας διακόπτης στην κύρια ηλεκτρική εγκατάσταση τροφοδοσίας ηλεκτρικού κοντά στη συσκευή.

ΣΥΝΘΗΚΕΣ ΛΕΙΤΟΥΡΓΙΑΣ

Τροφοδοσία ισχύος	100 ως 240 V ac/dc
Συχνότητα	50 – 60 Hz
Ισχύς ρεύματος	100 VA
Ηλεκτρική ασφάλεια	3.15 A / 250 V ac/dc

ΠΕΡΙΒΑΛΛΟΝΤΙΚΕΣ ΣΥΝΘΗΚΕΣ

Αποφεύγετε τη λειτουργία του κοντά σε εύφλεκτα υγρά ή αέρια. Η λειτουργία οποιασδήποτε ηλεκτρικής συσκευής σε τέτοιο περιβάλλον εκθέτει σε κίνδυνο για την ασφάλεια

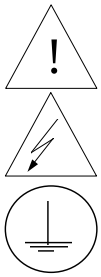
Θερμοκρασία	Περιβάλλοντος : 5 ως 40°C
	Αποθήκευσης : -20 ως 60°C
Υγρασία	10 ως 90 % RH μη συμπυκνώσιμη / 40°C
Δόνηση	10 – 40 Hz, ⊂⊕℘⊕∪∉© 0.07 ΔΔ
	40 – 60 Hz Επιτάχυνση 0.2 g

ΕΓΚΑΤΑΣΤΑΣΗ ΕΞΟΠΛΙΣΜΟΥ

Η μονάδα αυτή πρέπει να μπει μέσα σε πλαίσιο για να περιορίζεται η πρόσβαση του χρήστη στα πίσω τερματικά.

NORME DI SICUREZZA

IT2I-6063



Per ridurre i rischi di scariche elettriche che potrebbero causare alle persone, seguire tutte le precauzioni circa la sicurezza indicate in questa documentazione.

Questo simbolo avverte del pericolo di scossa elettrica nelle aree in cui sono accessibili conduttori sotto tensione.

Terminale di protezione verso terra. Previsto per il collegamento del conduttore di protezione verso terra del sistema di alimentazione.

- Se lo strumento viene utilizzato in modo diverso dalla specifica del costruttore, la protezione fornita dallo strumento puó essere diversa.
- Non sostituire alcun componente (o parte) non specificato esplicitamente come ricambio dal vostro fornitore.
- Tutti i cablaggi devono essere in accordo con i regolamenti locali e devono essere eseguiti da personale esperto ed autorizzato.
- Il terminale di massa deve essere collegato prima di ogni altro filo (e scollegato per ultimo).
- E necessario che sia presente un interruttore nell'alimentazione principale accanto all'apparecchio.

ALIMENTAZIONE APPARECCHIATURA

Tensione di alimentazione	Da 100 a 240 Vca/cc
Frequenza	50 – 60 Hz
Potenza o corrente	100 VA
Fusibile	3.15 A / 250 Vca/cc

CONDIZIONI AMBIENTALI

Non far funzionare l'apparecchio in presenza di liquidi o gas infiammabili, in quanto questo potrebbe essere estremamente pericoloso.

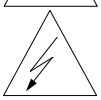
Temperatura	Ambiente : da 5 a 40°C
	Stoccaggio : da –20 a 60°C
Umidità relativa	Da 10 a 90% UR non condensata a 40°C
Vibrazioni	Da 10 a 40 Hz, ampiezza 0.07 mm
	Da 40 a 60 Hz, accelerazione 0.2 g

INSTALLAZIONE DELL'APPARECCHIO

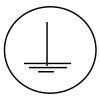
Il apparecchio deve essere montato su un pannello per limitare l'accesso ai terminali posteriori.

SIKKERHETSKRAV **NO2I-6063**

Følg alle retningslinjene i dette dokumentet, slik at du reduserer risikoen for elektrisk støt og mulige personskader.



Dette symbolet advarer brukeren om tilgjengelige terminaler med farlige spenninger og en potensiell fare for elektrisk støt.



Jordingsterminal. kabelen for jording av systemet skal tilknyttes til denne terminalen.

- Dersom utstyret benyttes på en måte annerledes enn spesifisert av produsent, kan utstyrets beskyttelsesgrad forringes.
- Ingen komponenter eller deler skal skiftes ut dersom de ikke er uttrykkelig spesifisert som utskiftbare av din forhandler.
- Det er påkrevet med en hovedstrømsbryter i nærheten av utstyret.
- All kabling må utføres i henhold til gjeldende forskrifter og installeres av autoriser og erfaren installatør.
- Jord må tilknyttes før all annen kabling (og frakobles sist).

UTSTYRSPESIFIKASJONER

Strømtilførsel	100 til 240 V AC/DC
Nettfrekvens	50 – 60 Hz
Kraftforbruk	100 VA
Sikringstørrelse	3.15 A / 250 V AC/DC

OMGIVELSER

Instrumentet må ikke opereres i nærheten av lettantennelige væsker eller gasser. Bruk av elektriske instrumenter i slike omgivelser utgjør en sikkerhetsrisiko.

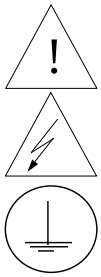
Temperatur	Omgivelse : 5 til 40°C
	Lagring : -20 til 60°C
Fuktighet	10 til 90% HR ingen kondensering / 40°C
Vibrasjon	10 til 40 Hz, amplitude 0,07 mm
	40 til 60 Hz, akselerasjon 0,2 g

UTSTYRSINSTALLASJON

Pass på å montere panelene på regulatoren, slik at berøring av terminalene på baksiden forhindres.

INSTRUÇÕES DE SEGURANÇA

PO2I-6063



Para reduzir o risco de choque eléctrico que pode causar danos corporais, seguir todas as normas de segurança contidas nesta documentação.

Este símbolo avisa o utilizador sobre um eventual perigo de choque quando são acessíveis voltagens sob tensão perigosas.

Terminal de protecção de terra. Fornecido para ligação do condutor do sistema da protecção de terra.

- Se este equipamento for usado de modo não especificado pelo fabricante, a protecção fornecida pelo equipamento pode não ser adequada.
- Não se deve substituir qualquer componente (ou peça) que não seja explicitamente especificado como substituível pelo nosso revendedor.
- Toda a cablagem deve estar de acordo com os códigos eléctricos locais e deve ser realizada por pessoal experiente devidamente autorizado.
- O terminal de terra deve ser ligado antes de ser feita qualquer outra cabelagem (e desligado em último lugar).
- Recomenda-se um comutador na fonte de alimentação principal próximo do equipamento.

ESPECIFICAÇÕES DO EQUIPAMENTO

Voltagem	100 a 240 Vca/cc
Frequência	50 – 60 Hz
Potência ou consumo de corrente	100 VA
Fusíveis	3.15 A / 250 Vca/cc

CONDIÇÕES AMBIENTAIS

Não operar o instrumento na presença de líquidos ou vapores inflamáveis. A operação de qualquer instrumento eléctrico em tal ambiente constitui um perigo para a segurança.

Temperatura	Ambiente : 5 a 40°C
	Armazenamento : -20 a 60°C
Humidade	10 a 90% RH não condensado a 40°C
Vibração	10 a 40 Hz, amplitude 0,07 mm
	40 a 60 Hz, aceleração 0,2 g

INSTALAÇÃO DO EQUIPAMENTO

O Registrador deve ser montado num painel para limitar o acesso do operador aos terminais traseiros.

NORMAS DE SEGURIDAD

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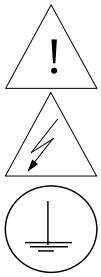

Para reducir el riesgo de choque eléctrico el cual podría causar lesiones personales, seguir todas las indicaciones de este documento.

Este símbolo previene al usuario de un riesgo potencial de descarga cuando se puede acceder a corrientes de tensión peligrosas.

Terminal de tierra de protección. Proporcionado para la conexión de la tierra de protección del conductor del sistema de alimentación.

- Si el equipo es utilizado de forma no especificada por el fabricante, la protección suministrada con el mismo podría resultar dañada.
- No reemplazar ningún componente (o parte) no explicitamente especificado por el suministrador.
- Todo el cableado debe realizarse de acuerdo con las normas eléctricas locales y debe ser realizado por personal experimentado.
- El terminal de tierra debe ser conectado antes que cualquier otro cable y desconectado el último.
- Se recomienda la instalación de un interruptor de la alimentación principal, cerca del equipo.

DATOS ELECTRICOS DEL EQUIPO

Tensión de alimentación	100 a 240 V ca/cc
Frecuencia	50 – 60 Hz
Potencia o corriente	100 VA
Fusible	3.15 A / 250 V ca/cc

CONDICIONES AMBIENTALES

No operar con el instrumento en presencia de liquidos o gases inflamables. La operación de cualquier equipo eléctrico en tal ambiente constituye un riesgo contra la seguridad.

Temperatura	Ambiente : 5 a 40°C
	Almacenamiento : -20 a 60°C
Humedad	10 a 90% RH sin condensados a 40°C
Vibración	10 a 40 Hz, amplitud 0,07 mm
	40 a 60 Hz, acceleración 0,2 g

INSTALACION DEL EQUIPO

Este equipo debe ser montado en un panel para limitar al operador el acceso a los terminales traseros.

SÄKERHETSFÖRESKRIFTER

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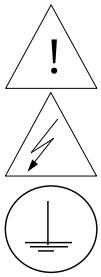

För att reducera riskerna av elektriska chocker som kan orsaka personskador, följ alla säkerhetsföreskrifter i denna dokumentation.

Denna symbol varnar användaren för risk för elchock vid tillfällig åtkomst av spänningsförande del.

Anslutning av skyddsjord. Avsedd för anslutning av elsysternets skyddsjordsledare.

- Om utrustningen används på ett sådant sätt, att det inte innefattas av tillverkarens specifikation, kan de inbyggda säkerhetsfunktionerna äventyras.
- Ersätt aldrig någon komponent (eller del) som inte är specificerad som ersättningsbar av tillverkaren.
- All ledningsdragning måste utföras i enlighet med lokala bestämmelser och skall utföras av behörig personal med erfarenhet av sådant arbete.
- Skyddsjordsanslutningen skall anslutas före alla andra anslutningar (och losskopplas sist).
- En strömbrytare för näströmmen rekommenderas.

STRÖMFÖRSÖRJNING

Spänning	100 a 240 V AC/DC
Frekvens	50 – 60 Hz
Effekt eller märkström	100 VA
Säkringsvärde	3.15 A / 250 V AC/DC

OMGIVNINGSVILLKOR

Använd ej instrumentet i närhet av brännbara vätskor eller gaser. Användandet av instrumentet i sådant miljö är en direkt säkerhetsrisk.

Temperatur	Omgivande : 5 till 40°C
	Förvaring : -20 till 60°C
Fuktighet	10 till 90% RH ej kondenserande / 40°C
Vibration	10 till 40 Hz, amplitud 0,07 mm
	40 till 60 Hz, acceleration 0,2 g

INSTALLATION

Instrumentet skall monteras i en panel eller i en låda för att undvika att personalen kommer i beröring med bakre inkopplingsplintar.

Index

P

R

S

T

U

V

W

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For application assistance, current specifications, pricing, or name of the nearest Authorized Distributor, contact one of the offices below.

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